A Number Game for the 6502

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DESCRIPTION

MASTERMIND is a number guessing game. In this version the computer generates a 5-digit, random number where the digits are limited to 0 through 7. The user attempts to guess the number in the fewest possible tries. After each guess the computer informs the user as to how many digits were correct (contained in the random number) and in the correct position by printing '+' signs, and how many digits are correct and in the wrong position with '–' signs. The user is not informed as to exactly which digit positions the '+' and the '– ' signs correspond. A skilled player can usually win in 6 or 7 tries.

THE PLAY

1. Computer prints 'READY?'

2. User hits any key when ready (not echoed). A random number is generated by counting from the 'READY?' message to key depression.

3. Computer prints '01' ↑ for move number
Cursor left here.

4. User enters his 5-digit guess following the move number. Remember that valid digits are 0 through 7 only. Entering any invalid character cancels the line and the computer repeats step 3 for the current move. This may be used to cancel errors.

5. Immediately after entering the 5th digit of his guess, the computer will print a number of '+' signs (for correct digits in correct positions) followed by a number of '– ' signs (for correct digits in incorrect positions). This 'score' is indicated to the right of the guess and does not indicate the specific digit positions involved. Play resumes at 3 for the *next* move number except for a win. Examples follow:

Scoring Examples for Random Number 12154

Move	Guess	Score	
01	33366		(none correct)
02	00018		(line cancelled due to invalid digit, 8)
02	00011	– –	(2 digits right, in wrong positions)
03	11234	++– –	(4 digits right, 2 in correct positions, 2 in wrong positions)
04	11325	+– – –	(4 digits right, 1 in correct position)
05	13216	+– –	(3 digits right, 1 in correct position)
06	44444	+	(1 digit right in correct position)
07	55555	+	(1 digit right, in correct position)
08	12154	+++++	YOU WIN (win message)

READY? (for next game)

RUNNING ON APPLE-1 SYSTEMS

The source and object listings provided will run on APPLE-1 systems. The program loads in locations $300 through $3AE and uses the following page 0 locations for variables:

$F2	TRIES	(no. of tries – 0 to 99 BCD)
$F3	RNDL	*Binary random number*
$F4	RNDH	
$F5	RND2L	(Temp.)
$F6-$FA	N	(5 digits of unpacked random no.)
$FB-$FF	GUESS	(User guess)

RUNNING ON OTHER SYSTEMS

1. The LDA STROBE instruction at loc. $313 (on supplied listing) senses for a key down condition after the READY? message. This is used to generate a random number corresponding to the delay before a key is depressed. The code is written for a negative value to indicate 'key down' ($b_7 = 1$) and a positive value ($b_7 = 0$) to indicate no key down. This instruction is followed by a JSR CHARIN instruction whose only purpose is to clear the strobe. The character returned is not used. Thus the user must provide an address for the LDA STROBE instruction corresponding to his hardware and must insure that the CHARIN subroutine clears the strobe.

2. A CHARIN subroutine must be provided to read one ASCII character with b_7 set. Do not use the CHARIN subroutine provided as it uses APPLE-1 I/O assignments. The character read must be returned in the A-Reg. The Y-Reg may be altered by CHARIN but not the X-Reg. If b_7 is returned clear (=0) then the EOR #$B0 instruction at loc. $34E (on supplied code) must be changed to an EOR #$30.

3. A COUT subroutine must be provided which outputs one ASCII character (passed in A-Reg). If the user output device requires line feeds with carriage returns then the COUT routine must intercept the carriage return character ($8D) and output the necessary CR-LF combination. All computer generated text has b_7=1. *No* registers (A,X,Y) may be altered.

4. PRBYTE subroutine must be provided which outputs one byte (passed in A-Reg) in hexadecimal (printing 2 digits). No registers need be preserved. The following routine will do:

```
PRBYTE   PHA            Save for LSD
         LSR
         LSR
         LSR            MSD to LSD position
         LSR
         JSR PRHEX*     Output MSD first
         PLA            Restore A
PRHEX    AND #$F        Mask LSD
PRHEX*   ORA #$B0       Add "0"
         CMP #$BA      (May be skipped if used for
         BCC TOCOUT    {MASTERMIND only, since
         ADC #$6       (only BCD digits supplied.
TOCOUT   JMP COUT       Output ASCII and return
```

```
                    XREF
             TRIES  EQU     $F2
             RNDL   EQU     $F3
             RNDH   EQU     $F4
             RND2L  EQU     $F5
             N      EQU     $F6
             GUESS  EQU     $FB
             COUT   EQU     $FFEF
             PRBYTE EQU     $FFDC
             KBD    EQU     $D010
             STROBE EQU     $D011
                    ORG     $300
0300 A2 08   MSTMND LDX     #$8
0302 BD 91 03 MSGLP LDA     MSG-1,X
0305 20 EF FF       JSR     COUT          PRINT 'READY?'
0308 CA             DEX
0309 D0 F7          BNE     MSGLP
030B 86 F2          STX     TRIES         SET TRIES TO ZERO.
030D E6 F3   RNDLP  INC     RNDL
030F D0 02          BNE     RND2          FORM 2-BYTE RANDOM NUMBER
0311 E6 F4          INC     RNDH          UNTIL KEY DOWN.
0313 AD 11 D0 RND2  LDA     STROBE
0316 10 F5          BPL     RNDLP
0318 20 A8 03       JSR     CHARIN        CLEAR STROBE.
031B 38      NXTRY  SEC
031C F8             SED
031D 8A             TXA
031E 65 F2          ADC     TRIES         ADD 1 TO TRIES IN DECIMAL MODE
0320 85 F2          STA     TRIES
0322 D8             CLD
0323 20 A3 03 NXTLIN JSR    CRLF
0326 A5 F2          LDA     TRIES         OUTPUT CRLF AND TRIES (IN BCD)
0328 20 DC FF       JSR     PRBYTE
032B A9 A0          LDA     #$A0          OUTPUT BLANK.
032D A8             TAY
032E 20 EF FF       JSR     COUT
0331 A5 F3          LDA     RNDL
0333 85 F5          STA     RND2L
0335 A5 F4          LDA     RNDH
0337 A2 05          LDX     #$5           SET ARRAY N TO 5 DIGITS OF
0339 94 F5   DIGEN  STY     N-1,X         RANDOM NUMBER.  DIGITS ARE
033B A0 03          LDY     #$3           0 THROUGH 7.
033D 4A      BITGEN LSR     A
033E 26 F5          ROL     RND2L
0340 36 F5          ROL     N-1,X
0342 88             DEY
0343 D0 F8          BNE     BITGEN
0345 CA             DEX
0346 D0 F1          BNE     DIGEN
0348 20 A8 03 RDKEY JSR     CHARIN        READ AND ECHO A CHARACTER.
034B 20 EF FF       JSR     COUT
034E 49 B0          EOR     #$B0          CONVERTS DIGITS TO TRUE VALUE.
0350 C9 08          CMP     #$8           IF NOT 0 TO 7 THEN REPEAT LINE
0352 B0 CF          BCS     NXTLIN        WITH SAME TRIES VALUE.
0354 95 FF          STA     GUESS+4,X     SAVE USER DIGIT.
0356 CA             DEX
0357 E0 FB          CPX     #$FB          DONE 5 DIGITS?
0359 D0 ED          BNE     RDKEY
035B A0 FB          LDY     #$FB          WIN COUNT (FOR 5 MATCHES).
035D A9 A0          LDA     #$A0          PRINT' BLANK.
035F 20 EF FF PLUS1 JSR     COUT
0362 B5 00   PLUS2  LDA     GUESS+5,X     DOES GUESS MATCH RANDOM NUMBER
0364 D5 FB          CMP     N+5,X         FOR THIS DIGIT POSITION?
0366 D0 0D          BNE     PLUS3         NO, TRY NEXT POSITION.
0368 94 FB          STY     N+5,X         SETS DIG OF RAND NUMBER TO $FB
036A A9 AB          LDA     #$AB          -$FF SO NO 'MINUS' MATCH.
036C 95 00          STA     GUESS+5,X     SET DIGIT OF GUESS TO $AB SO
036E C8             INY                   *  NO 'MINUS' MATCH.
036F D0 EE          BNE     PLUS1         INCR. WIN COUNTER AND LOOP.
0371 A2 11          LDX     #$11          IF WIN, OUTPUT WIN MESSAGE
0373 D0 8D          BNE     MSGLP         *  AND BEGIN NEW GAME.
0375 E8      PLUS3  INX                   * NEXT DIGIT OF 'PLUS' SCAN.
0376 D0 EA          BNE     PLUS2
0378 A0 FB          LDY     #$FB
037A B6 00   MINUS1 LDX     GUESS+5,Y     GET DIGIT OF USER GUESS.
037C 8A             TXA
037D A2 FB          LDX     #$FB
037F D5 FB   MINUS2 CMP     N+5,X         COMP TO DIGIT OF RAND NUMBER.
0381 D0 07          BNE     MINUS3        NO MATCH.
0383 94 FB          STY     N+5,X         SET RAND DIGIT TO $FB-$FF
0385 A9 AD          LDA     #$AD          SUBSTITUTE $AD FOR GUESS DIGIT
0387 20 EF FF       JSR     COUT
038A E8      MINUS3 INX                   * NEXT RANDOM DIGIT.
038B D0 F2          BNE     MINUS2        *    LOOP.
038D C8             INY                   * NEXT USER DIGIT.
038E D0 EA          BNE     MINUS1        *    LOOP.
0390 F0 89          BEQ     NXTRY         UPDATE TRIES FOR NEXT LINE.
0392 BF      MSG    DFB     $BF           '?'
0393 D9             DFB     $D9           'Y'
0394 C4             DFB     $C4           'D'
0395 C1             DFB     $C1           'A'
0396 C5             DFB     $C5           'E'
0397 D2             DFB     $D2           'R'
0398 8D             DFB     $8D           CR.
0399 8D             DFB     $8D           CR.
039A CE             DFB     $CE           'N'
039B C9             DFB     $C9           'I'
039C D7             DFB     $D7           'W'
039D A0             DFB     $A0           BLANK
039E D5             DFB     $D5           'U'
039F CF             DFB     $CF           'O'
03A0 D9             DFB     $D9           'Y'
03A1 A0             DFB     $A0           BLANK
03A2 AB             DFB     $AB           '+'
03A3 A9 8D   CRLF   LDA     #$8D
03A5 4C EF FF       JMP     COUT
03A8 AD 11 D0 CHARIN LDA    STROBE        WAIT FOR STROBE
03AB 10 FB          BPL     CHARIN
03AD AD 10 D0       LDA     KBD           READ KEY AND CLEAR STROBE.
03B0 60             RTS
                    END
CROSS REFERENCE TABLE      28 SYMBOLS  DEFINED

BITGEN  033D   0043   0047
CHARIN  03A8   0107   0024   0050   0108
COUT    FFEF   0008   0015   0036   0051   0061   0082   0106
CRLF    03A3   0105   0031
DIGEN   0339   0041   0049
GUESS   00FB   0007   0055   0062   0067   0075
KBD     D010   0010   0109
MINUS1  037A   0075   0086
MINUS2  037F   0078   0084
MINUS3  038A   0083   0079
MSG     0392   0088   0014
MSGLP   0302   0014   0017   0071
MSTMND  0300   0013
N       00F6   0006   0041   0045   0063   0065   0078   0080
NXTLIN  0323   0031   0054
NXTRY   031B   0025   0087
PLUS1   035F   0061   0069
PLUS2   0362   0062   0073
PLUS3   0375   0072   0064
PRBYTE  FFDC   0009   0033
RDKEY   0348   0050   0058
RND2    0313   0022   0020
RND2L   00F5   0005   0038   0044
RNDH    00F4   0004   0021   0039
RNDL    00F3   0003   0019   0037
RNDLP   030D   0019   0023
STROBE  D011   0011   0022   0107
TRIES   00F2   0002   0018   0028   0029   0032
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