

Here's another of this year's Octojam entries, from fellow VIPer Tobias V. Langhoff. He writes that this is his first CHIP-8 program ever! As you will see later in this issue, it was not his last; he also submitted another one. Thanks for the entries, Tobias. --ED.

## MINI LIGHTS OUT

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This small puzzle game consists of a 4x4 grid of lights that are either turned on or off in a random pattern. Your goal is to turn off all the lights.

Pressing a light turns it off, but it also toggles all four adjacent lights above, below, and to the left and right. If one of these adjacent lights were on, it is turned off, but if it were off already, it gets turned on again. This adjacency "wraps" around the edges, as if the grid were in fact a torus, meaning that pressing a light always affects five lights.

Note that you're only allowed to press lights that are turned on.

## CONTROLS

If you're lucky enough to have a Touch Screen board, you can simply press a light on your screen to toggle it.

If you're using an ASCII keyboard rather than a COSMAC VIP hexadecimal keyboard, the following keys are used for the corresponding lights:

1	2	3	4
Q	W	E	R
A	S	D	F
Z	X	C	V

## HISTORY

In 1995, Tiger Toys released a physical game toy called Lights Out. This was played on a 5x5 grid, and the lights did not "wrap around" the edges as it does in this version -- ie. the light in the top left corner only toggled itself, the light below it and the light to the right of it.

Several variations of this game were released over the years, including Mini Lights Out, the version in this game. The fact that the lights wrap around in this version means that all patterns are solvable, which was not the case for the original Lights Out. This allows for a procedurally generated sequence of patterns, so you can have nearly endless games to play. Well, 65,535 of them at least.

## TIPS

If you find the game too difficult, you can remove the restriction that disallows pressing lights that are turned off. To do so, simply jump over this check by changing:

0384 from A3E1 to 1394

This version of the game is very simple once you learn the following trick. Please skip this if you don't want any hints, including for the unmodified version of the game.

1. Press one of the lights to turn it off
2. Press each of that light's adjacent buttons, in succession  
(regardless of whether its light is on or off)
3. Repeat for the next light

You can use this strategy on the main, unmodified game as well, although step 2 obviously needs to be amended, since you're not necessarily able to press all the adjacent buttons at this stage. This amendment is left as an exercise to the player.

# CODE LISTING

```

0200 START: 00E0 -- Set up title screen
      02      6032
      04      F018 -- Change this to 8000 to avoid sound on VIP
      06      A3C8 -- Draw LOGO
      08      6A11
      0A      6B08
      0C      6C07
      0E      DAB7
0210      FC1E
      12      7A08
      14      DAB7
      16      FC1E
      18      7A08
      1A      DAB7
      1C      FC1E
      1E      7A08
0220      DAB7
      22      6A11
      24      7B08
      26      FC1E
      28      7A08
      2A      DAB7
      2C      FC1E
      2E      7A08
0230      DAB7
      32      FC1E
      34      7A08
      36      DAB1
      38 TITLE: 6032 -- Title/win screen loop
      3A      F015
      3C      4F01
      3E      F018 -- Change this to 8000 to avoid sound on VIP
0240      A3B8 -- Load KEYS mapping
      42      FE65
      44 BLINK: E0A1 -- Check for input,
      46      12AE -- jump to INIT if any key is pressed
      48      E1A1
      4A      12AE
      4C      E2A1
      4E      12AE
0250      E3A1
      52      12AE
      54      E4A1
      56      12AE
      58      E5A1
      5A      12AE
      5C      E6A1
      5E      12AE

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0260      E7A1
      62      12AE
      64      E8A1
      66      12AE
      68      E9A1
      6A      12AE
      6C      EAA1
      6E      12AE
0270      EBA1
      72      12AE
      74      ECA1
      76      12AE
      78      EDA1
      7A      12AE
      7C      EEA1
      7E      12AE
0280      6F0F -- Handle F key specifically,
      82      EFA1 -- because VF is mangled otherwise
      84      12AE
      86      FF07 -- Check delay timer
      88      3F00 -- If the delay timer is 0
      8A      1244 -- Jump to BLINK
      8C      A424 -- Load solid LIGHT sprite
      8E      6AF8 -- Draw it on entire screen to invert periodically
0290      6BF1
      92      7B0F
      94      4B2D
      96      12AC
      98      7A08
      9A      4A40
      9C      12A8
      9E      4B1E
02A0      DAB2
      A2      3B1E
      A4      DABF
      A6      1298
      A8      6AF8
      AA      1292
      AC INIT: 1238 -- Jump to TITLE and repeat the process
      AE      6D00 -- Initialize step counter
02B0      FD18 -- Stop sound
      B2      A41D -- Load BTN sprite
      B4      CCFF -- Randomize top half of the grid
      B6      CEFF -- Randomize bottom half of the grid
      B8      8BC0
      BA      8BE2
      BC      4B00 -- Check if all lights are off already
      BE      12AE -- Jump to INIT to try again

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02C0      00E0 -- Clear screen
  C2      6A08
  C4      6BF8 -- Draw grid on screen
  C6      4B00
  C8      8CE0
  CA      4B10
  CC      8CE0
  CE      7B08
02D0      4B20
  D2      12EE
  D4      7A08
  D6      4A30
  D8      12EA
  DA      DAB7
  DC      8CC6
  DE      3F01
02E0      12E8
  E2      A424
  E4      DAB8
  E6      A41D
  E8      12D4
  EA      6A08
  EC      12C6
  EE      2350 -- Do STEPS to draw step counter
02F0 GAME: F30A -- Wait for input
  F2      1366 -- Jump to PRESS
  F4      2350 -- Do STEPS to erase step counter
  F6      7D01 -- Increase step counter
  F8      4D64 -- Check if step counter is 100
  FA      1200 -- Jump to START if so
  FC      2350 -- Do STEPS to re-draw step counter
  FE      A3E1 -- Load TEST sprite
0300      6A08 -- Draw and erase TEST on entire grid
  02      6B08 -- to see if all lights are off
  04      7B08
  06      4B30
  08      131E
  0A      7A08
  0C      4A30
  0E      131A
0310      DAB1
  12      DAB1
  14      4F01 -- If we found a collision, ie. a light is on:
  16      12F0 -- Jump to GAME
  18      130A
  1A      6A08
  1C      1304
  1E      00E0 -- Clear the screen, the game is won!

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0320      2350 -- Do STEPS to draw step counter again
      22      A3F3 -- Load WIN sprites and draw them on screen
      24      6A14
      26      6B08
      28      6C07
      2A      DAB7
      2C      FC1E
      2E      7A08
0330      DAB7
      32      FC1E
      34      7A08
      36      DAB7
      38      6A0C
      3A      7B08
      3C      FC1E
      3E      7A08
0340      DAB7
      42      FC1E
      44      7A08
      46      DAB7
      48      FC1E
      4A      7A08
      4C      DAB7
      4E      1238
0350 STEPS: A433 -- Load BCD memory location
      52      FD33 -- Save BCD representation of step counter
      54      F265 -- Load BCD representation into V0, V1, V2
      56      6A34 -- Draw two least significant digits
      58      6B0E
      5A      F129
      5C      DAB5
      5E      7A05
0360      F229
      62      DAB5
      64      00EE -- Return
      66 PRESS: 8030 -- A light has been pressed
      68      A3B8 -- Map pressed key to light on grid using KEYS
      6A      F01E
      6C      F065
      6E      8A00
0370      8B00
      72      6C03 -- Find X position of pressed light
      74      8AC2 -- Mask off lower 2 bits
      76      8AAE -- Multiply by 8 to find pixel
      78      8AAE
      7A      8AAE
      7C      7A10 -- Grid is offset 16 pixels
      7E      6C1C -- Find Y position of pressed light

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0380      8BC2 -- Mask off upper 3 bits
      82      8BBE -- Multiply by 2 to find pixel
      84      A3E1 -- Load TEST sprite
      86      DAB1 -- Draw TEST sprite
      88      DAB1 -- Erase TEST sprite
      8A      3F00 -- Check for collision
      8C      1394 -- Jump to TOGGLE if not
      8E      600A
0390      F018 -- Play error sound
      92      12F0 -- Jump to GAME
      94 TOGGLE A424 -- Load LIGHT sprite
      96      DAB8 -- Toggle the pressed button
      98      83A0 -- Toggle left light
      9A      7AF8
      9C      4A08
      9E      7AE0
03A0      DAB8
      A2      8A30 -- Toggle right light
      A4      7A08
      A6      4A30
      A8      7AE0
      AA      DAB8
      AC      8A30 -- Toggle light above
      AE      7BF8
03B0      DAB8
      B2      7B10 -- Toggle light below
      B4      DAB8
      B6      12F4 -- Jump back in the middle of GAME loop
      B8 KEYS: 0D00 -- Table mapping keys to grid location
      BA      0102
      BC      0405
      BE      0608
03C0      090A
      C2      0C0E
      C4      0307
      C6      0B0F
      C8 LOGO: 8484 -- "LIGHTS OUT"
      CA      8484
      CC      8484
      CE      F471
03D0      C981
      D2      9989
      D4      C971
      D6      1711
      D8      11F1
      DA      1111
      DC      11CE
      DE      1110

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03E0      0E
E1 TEST:  01  -- 1-pixel TEST sprite is located here
E2        110E
E4        71D9
E6        8989
E8        89D9
EA        7017
EC        1111
EE        1111
03F0      11E1
F2        C082
F4        4529
F6        1111
F8        1110
FA        F199
fc        0909
FE        0999
0400 WIN : F008
02        0808 -- "YOU WIN"
04        0808
06        08F0
08        4444
0A        2A2A
0C        2A11
0E        1152
0410      5392
12        9292
14        1212
16        1010
18        9090
1A        5030
1B        10
1C BTN:   00  -- Button sprite
1E        7E7E
10        7E7E
0422      7E7E
24 LIGHT: FFFF -- Light sprite
26        FFFF
28        FFFF
2A        FFFF
2C        FFFF
2E        FFFF
20        FFFF
0432      FF
34 BCD:   0000 -- Number of steps
36        00  -- for BCD

```