Implementation notes for tricks described in

Ronald I. Greenberg. Educational magic tricks based on error-detection schemes. In Proceedings of the 22nd Annual SIGCSE Conference on Innovation and Technology in Computer Science Education, July 2017.

Presented here are concise explanations of how to reveal the secret flips in each of the versions of the magic trick, including an indication of implmementation details for Versions 3 and 5 that are not fully described in the paper. (Even here, there are some deeper details that may not be fully understood without reading the JavaScript code.) The explanations are for the default grid sizes noted below. (For Versions 1, 2a, and 2b, one can also append, for example, "&n=12", to work with a 12×12 grid, but Version 2b will "round up" to a value that is 1 mod 3. In version 5, one may append, e.g., "&d=4" to obtain a $2^4 \times 2^4$ grid.)

1 Version 1 (6×6 grid after expansion)

To reveal the secret flip:

1. Choose the row among the first four that has an odd number of white tiles; if none, choose the last row.

2. Choose the column among the first four that has an odd number of white tiles; if none, choose the last column.

3. The secret tile is at the intersection of the selected row and column.

2 Version 2a (8×8 grid)

To reveal the secret flip:

1. Choose the row among the first seven that has different parity (number of white tiles) than the others; if none, choose the last row.

2. Choose the column among the first seven that has different parity than the others; if none, choose the last column.

3. The secret tile is at the intersection of the selected row and column.

3 Version 2b (10×10 grid)

To reveal the secret flip:

1. Choose the row among the first three that has different parity (number of white tiles) than the others; if none, consider the next three rows, etc., with the last row as the final default.

2. Do the same process with the columns.

3. The secret tile is at the intersection of the selected row and column.

4   Version 3 (10×10 grid)

To reveal the last flip, use the same process as in Version 2b. To reveal the flip before:

1. Write down the row and column numbers of the three flips that the computer requests.

2. Consider two cases according to whether all rows are distinct.

Case I: If some row appears twice, set s to that row number. If the third row is less than s, reduce s by one.

Case II: Otherwise, look at the order of the rows in the three flips, denoting the least row as 0, the greatest row as 2, and the middle row as 1. Set s according to the order found:

0,1,2: $s = 0$.
0,2,1: $s = 1$.
1,0,2: $s = 2$.
1,2,0: $s = 3$.
2,0,1: $s = 4$.
2,1,0: $s = 5$.

3. Perform the same process with the columns for the three flips to get a value for t.

4. Let d be the number of drumrolls (0, 1, or 2) that the computer requests *after* the first reveal.

5. Compute $6s + t + 35d$; the ten's place and one's place of this result indicate the row and column of the secret flip.

(An alternative implementation could slightly simplify this process, but it is also of interest to observe in the JavaScript code that the implementation ensures that the three flips the computer requests are distinct.)

5   Version 4 (11×11 grid)

To reveal the secret flip:

1. Compute the row number of the computer-requested flip times 5 mod 11 to get the row number of the secret flip.

2. Compute the column number of the computer-requested flip times 7 mod 11 to get the column number of the secret flip.

6   Version 5 (8×8 grid)

To reveal the secret flip:

1. Choose the quadrant among the first three that has different parity (number of white tiles) than the others; if none, choose the last quadrant.

2. Choose the pair of rows, 0 & 4, 1 & 5, or 2 & 6, that has different parity than the others; if none chose the last pair of rows (3 & 7).

3. Choose the pair of columns, 0 & 4, 1 & 5, or 2 & 6, that has different parity than the others; if none chose the last pair of columns (3 & 7).

4. The secret tile is at the intersection of the selected quadrant, row pair, and column pair.