Épreuve de section européenne

Yates four-object divination

The magician Jack Yates, in *Minds in Close-up*, describes an intriguing trick with four matches.

The four matches are placed on a table side by side in a row, in positions which we shall designate as 1, 2, 3, and 4. The match on the fourth position should be placed upside down.

The magician puts a blindfold in order not to see the following operations.

Then, he asks a volunteer from the audience to make five switches, each time exchanging the upside down match with the match directly on its right or its left. The volunteer must tell nothing whatever about the nature of these five switches – of course there is only one possibility for the first switch.

After the switches are done, the magician asks the volunteer to remove three matches, one at a time, as follows: he instructs to take away the match which is at position 4. After this is done, the magician asks the volunteer to switch the upside down match once more with an adjacent one. Finally, he asks the volunteer to remove the first and last matches... the upside down one being the only one left on the table.

Adapted from *Mathematics, magic and mystery*, Martin Gardner

Questions

1. Recap the trick in your own words, and do it with 4 pens instead of the 4 matches.

2. Why is there only one possibility for the first switch ?

3. After the first five switches, one would think the upside down match might be brought to any position in the row. This is not the case. Starting from position 4, it will always end up at 1 or 3.

   Explain why the upside down match will always end at an odd position.

4. Explain why "he asks the volunteer to remove the first and last matches".

5. Adapt the trick when the upside down match starts at position 3.

6. Does the trick still work with 6 matches ?