

Magic tricks, Group testing and de Bruijn sequences

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In the classic version of this magic trick, the magician asks one spectator thinking of an integer between 0 and 15 and keeping it in his mind. Then the spectator is allowed to ask four yes-or-no questions that whether the chosen number appears on the four cards. After that, the magician will immediately know what is the number in spectator's mind. The secret mainly depends on 1-disjunct matrix in group testing. Theoretically, this trick can be extended to any n numbers with $O(\log n)$ question cards. Richard Ehrenborg [1] and Todd Mateer [2] modified this trick to the version that the spectator is allowed to lie at most once by asking 3 more questions. These question cards are encoded by Hamming code. The former 4 question cards are correspondent to the 4 information bits of $[7, 4, 3]$ -code, and the new 3 cards are the 3 parity-check bits. In general, for any positive integer n , the magician also needs $O(\log n)$ question cards. In this talk, we reduce the number of question cards to $O(1)$. Actually, we need only 1 base card and 1 question card.

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