

An Amazing Mathematical Trick with Cards

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One of the finest of all mathematical magic tricks, not well known even to card magicians, was invented by the American Howard Adams. It was first published in his now rare 1984 booklet with the strange title *OICUFESP* (Oh, I see you have ESP).

I urge you to get a deck of cards and astonish yourself by following these simple instructions. First prepare by removing from the deck a set of five pairs of 'mated' cards. (A mate to a card is a card with the same value and color, i.e. the mate of the Queen of Hearts is the Queen of Diamonds). Call the five cards **ABCDE** and their mates **abcde**, and arrange them in order **ABCDEabcde** and place the packet of cards face down on a table. Then you can cut the packet as many times as you want. (Cutting a packet means to separate it by a cut and transposing the two pieces, keeping the orientation of the cards.) Then split it in half (i.e. cutting it into two pieces of five cards each) and place the halves face down on a table, side by side. Then turn the five-card pile on the right face up.

You are now going to spell the words in the phrase 'LAST TWO CARDS MATCH' in the following way. Pick up either pile and spell the letter *L* by moving the top card of the pile to the bottom and put it back on the table without turning it over. Likewise spell the second letter *A* of 'Last' by once again picking a pile at random and moving its top card to the bottom and putting it back keeping the orientation of its cards. The spellings of *S* and *T* are done in the same way. After the first word is completed we have two piles, one face up, the other face down. Now remove the top cards of each pile and set them aside, side by side, at some vacant spot on the table. One will be face down the other face up. (You may for convenience arrange it so that the card which is face up is on the right) Repeat the process with the remaining piles of four by spelling the word 'T-W-O' at each stage picking up a random pile. After it is done, remove the two top cards and put them side by side as before, below the previously placed pair. Proceed by spelling C-A-R-D-S and M-A-T-C-H with remaining piles of three and two cards respectively. You will end up with two columns of cards, (face down on the left, face up on the right), the lowermost pair being the two cards which are left in the piles, namely the last two cards. Look at them and turn over the face-down card. Surprise! It matches the other card! The prediction 'Last two cards match' has been mysteriously fulfilled!

Is the trick over? Not by any means. There is a second, even greater climax. Turn over the remaining four face-down cards in the column. Each of those will match its mate!

Maybe you can figure out why the trick works. It is based on modular arithmetic.

Once you have figured out why, you may be ready to face the even bigger linguistic challenge of devising a similar magic formula, in the language of your choice, that will work for larger sets of cards, even for the entire deck!

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