# Card Trick 2

Materials:
A standard deck of cards

Start:

Step 1) Have a friend shuffle a standard 52-card deck to his/her satisfaction. Then ask him/her to turn over, face up, a pile of twenty-five cards. As they count out the cards to twenty-five, act like you are intensely memorizing every single one of them in order. In truth you are only interested in the $17^{th}$ card in the pile. Memorize that card.

Step 2) Turn the twenty-five card pile over, now face down, and set aside.

Step 3) Take the remaining cards and pick a card off the top of the deck and do the following:

a) If it is a two through nine card, place it face up, and count out cards up to the number ten.

ex 1) For instance, if you turn up a six, you would place it face up, and then count out four cards (face down but not cover up the original card) counting up, (cards can be face up in this part) saying: "seven, eight, nine, ten"

ex 2) If you turned up a three, then seven cards, saying: "four, five, six, seven, eight, nine, ten"

b) If the card you turn up is an ace, ten, or picture, tell your friend that you must have cards two through nine for this trick and place the card on the bottom of the deck, face down like the rest of the cards.

Step 4) Repeat this procedure until you have completed four columns of ten counts.

Step 5) Take whatever remaining cards you have after making the four columns, and place them face down on TOP of the twenty-card pile you set aside earlier.

Step 6) Now ask your friend to total up the numbers at the top of the four columns. ex 1) Total was 23.

Step 7) Counting from the very top of the set-aside-pile-plus-remainder-cards, state you are interested in the 23rd card. Just before turning over the 23rd card, state that it is the card that you memorized at the beginning of the trick!

If you did everything correctly, it works every time! Amazing!

Mathematical reason how it works:

Step 2) After this step your card is 17 cards from the top of the deck.

Step 3) You have four piles of cards where we will let the top cards be called a, b, c, d; i.e. from ex 1) above a = 6
The number of cards in all the stacks will be:
$10 - a + 1 + 10 - b + 1 + 10 - c + 1 + 10 - d + 1 = 44 - (a + b + c + d)$
(Note: from ex 1) above when a = 6 there will be 5 cards in that stack: 10 - 6 + 1)

Step 5) Recall: There are 52 cards in the deck and 25 in the set aside pile that has the memorized card 17 cards down; that leaves 27 cards to be put in stacks and as left overs. The number of left over cards will be:
$27 - 44 - (a + b + c + d)$ or $-17 - (a + b + c + d)$

Step 6) Total will be $(a + b + c + d)$

Step 7) The 17 cards in the set aside pile and the -17 from step 5) cancel each other out so the number of cards to count down to get to the memorize card will be the total from step 6) i.e. $(a + b + c + d)$

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