Épreuve de section européenne

You Can't Beat the Odds

Suppose, for the sake of argument, that you live in a large city such as Paris or Berlin. You are seated on a bus ; a passenger departs, leaving behind an umbrella. You take the umbrella, with the idea that when you get home, you will pick up the phone and dial seven random numbers in the hope of reaching the owner of the umbrella (provided that the first three digits are the same for all ten-digit telephone numbers in the city).

This is, of course, a made-up story, and such a plan in real life would be ridiculed as hopelessly naive. But don't laugh too quickly, because many of your fellow citizens have the hope every Friday evening of having chosen the correct lottery numbers, the probability of which is 1 in 13,983,816. Such odds are worse than those of locating the owner of the umbrella according to the plan described above, since there are "only" ten million random sequences of seven digits.

Many lottery players imagine that they can outwit chance by choosing numbers that have not appeared frequently in the past. Such a strategy is wholly without merit, for chance has no memory. Even if, say, the number 13 hasn't been drawn in a long time, in today's drawing it has exactly the same probability of being chosen as any of the other numbers.

In fact, there is some positive action that a lottery player can take, and that is to choose a combination of numbers that is unlikely to be chosen by many other players. Then if, by some small chance, one wins, it is less likely to have to share the prize with a large number of winners. That, however, is easier said than done. On one recent occasion, many lottery winners saw their dreams of millions greatly reduced when it turned out that the winning numbers, which formed a cross on the selection card, had been chosen by a surprisingly large number of people.

Adapted from Ehrhard Behrends' *Five-Minute Mathematics*, AMS, 2008.

Questions

1. Explain the ten million possibilities you have for the random telephone number.
2. Assuming that when you play the lottery you have to choose choose 6 numbers out of 49 numbers, explain the probability of 1 in 13,983,816 which is mentioned in the text for a winning ticket.
3. Explain : "chance has no memory".
4. In the last paragraph of the text, the author mentions a cross on the selection card ; how is it possible ?
5. In the American Mega Millions Lottery (Mega Millions tickets cost \$1.00 each), players pick six numbers from two separate pools of numbers - five different "white" numbers in a list from 1 to 56 and one "yellow" number in a list from 1 to 46. You win the jackpot by matching all six winning numbers in a drawing. The chances of winning the Jackpot are written to be 1 in 175,711,536. Is this correct ?