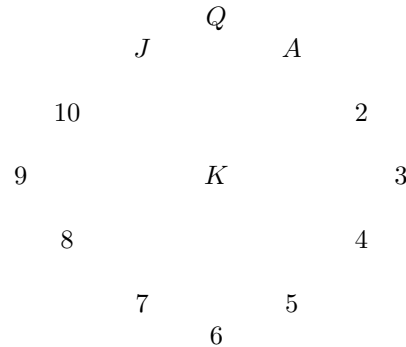**Clock solitaire**

In the game of clock solitaire, you begin by dealing the 52 cards of a standard deck face down into thirteen piles of four cards each, arranged as follows:

$$Q$$
$$J \qquad A$$
$$10 \qquad\qquad 2$$
$$9 \qquad K \qquad 3$$
$$8 \qquad\qquad 4$$
$$7 \qquad 5$$
$$6$$

The twelve outside piles correspond as indicated to the ranks $A, 2, 3, 4, 5, 6, 7, 8, 9, 10, J, Q$. The inside pile corresponds to the king. To play this fascinating game, you take the top card from the king pile, and slip it face up underneath the cards of the pile it indicated. For example, if the top card in the king pile is a 3, you slip it under the pile at 3 o'clock; if the card is itself a king, you slip it face up underneath the king pile. To proceed, you take the top card from the pile underneath which you slipped the first card, and slip it under its corresponding pile, take the top card from that pile, and so forth. No choices are to be made. You simply proceed until you turn up the fourth king, slip underneath the three upward-facing kings in the king pile, and are stuck. If at this point all the cards are face-up, you win. Otherwise you lose. Or rather, you cheat: The approved way to cheat is to turn up the first face-down card you encounter starting from the ace pile and going around clockwise, and proceed to stick this card underneath its pile, etc., until you get stuck again. If you still haven't won, cheat again! Try it—you'll like it.

The probability of winning

The probability of winning this game (honestly, on the first round) is 1/13. The reason is that each of the 52! possible sequences of cards that you might encounter in the extended game (including cheating after you get stuck, if necessary) is equally likely, and you will have won if and only if the last card in this sequence is a king, and this is true with probability 1/13.

The point here is that every time you turn up a card, it is equally likely to be any of the cards you haven't encountered yet. The fact that you are taking it from a certain spot in the layout is entirely irrelevant. Instead of laying the cards out in advance, you can just go through the deck, taking the top card and putting it where it belongs, then putting the next card where it belongs, etc. If you get the fourth king before you reach the end of the deck, you lose. So if you're lazy, you can just look through the deck without actually putting the

cards where they belong; if you find the fourth king before you reach the end of the deck, you lose. Or, if you're really lazy, you can just look at the bottom card; if it isn't a king, you lose.

Viewed in this way, clock solitaire isn't very exciting. Its main practical interest is as a way of enlivening the job of sorting a deck into ranks. However, this game is of theoretical interest because of the light it sheds on the combinatorics of spanning trees in a graph.

Leaving Saint Louis