A MATHEMATICIAN AT PLAY

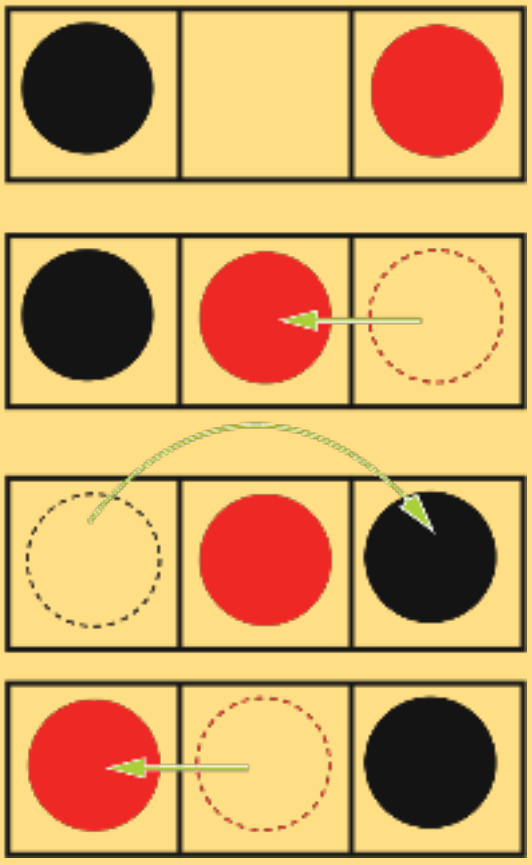
Slide, jump and switch places

Games have inspired mathematical puzzles since people began playing them. A puzzle is a kind of solitaire, after all. Join Daniel Finkel to explore a few puzzles that are inspired by checkers.

Today's puzzle, however, is only loosely inspired by checkers: there are no kings, no taking other pieces, and no diagonal movement. There are two colours of checkers, though, and there is jumping.

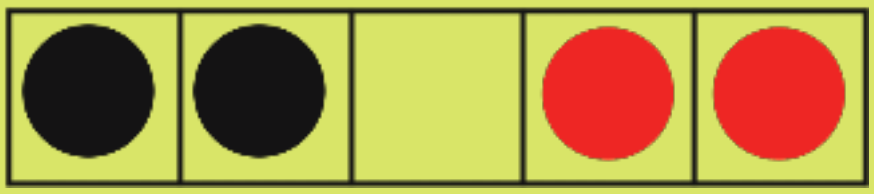
Your goal in these puzzles is to switch the red and black checkers. Red can either slide one space to the left, or jump left over a checker. Black moves right, either by sliding one space or by jumping. Checkers can only move to vacant spaces.

For example, it takes just three moves to switch one black and one red checker (as shown below):

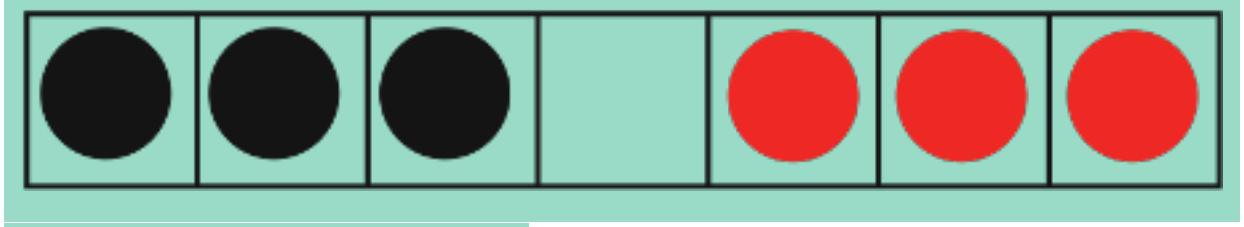


Dotted image shows position before the move.

It takes, as you can check, eight moves to switch two black checkers with two red checkers.

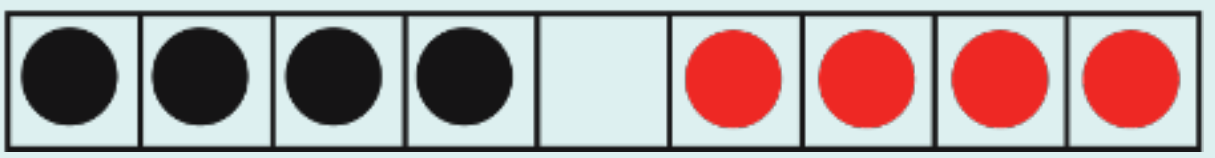


But be careful: it is possible to hit a dead end as you try to solve the puzzle, like this one.



PUZZLE 1 Find a way to switch three black and three red checkers. How many moves does it take?

PUZZLE 2 How many moves does it take to switch four black and four red checkers?



RESEARCH Can you find a general formula for the number of moves it takes to switch n black and n red checkers, on a line with 2n + 1 spots (so there is just one vacant spot in the centre).

Dan Finkel is the founder of Math for Love, an organisation devoted to transforming how math is taught and learned. He is the creator of mathematical puzzles, curriculum, and games, including the best-selling *Prime Climb* and *Tiny Polka Dot*.

PUZZLE 3 Let's extend this puzzle into two dimensions! Find a way switch the black and red checkers now, assuming the same rules; here the red checkers must move left or up, and the black checkers must move right or down. How many moves does it take to complete the puzzle?