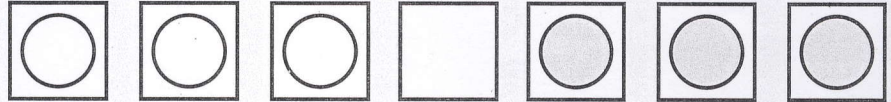


This POW is about solving a puzzle or, rather, about solving a whole set of puzzles. Each of these puzzles requires two sets of markers, such as coins of two different types. We will use plain and shaded circles to represent the markers.

An Example

One of these puzzles uses three markers of each kind. At the beginning of the puzzle, the markers are arranged as shown below, with each marker in a square. The plain markers are at the left, the shaded markers are at the right, and there is one empty square in the middle.



The task in the puzzle is to move the markers so that the shaded markers end up at the left and the plain markers end up at the right. Of course, there are some rules.

- The plain markers move only to the right and the shaded markers move only to the left.
- A marker can move to an adjacent open square.
- A marker can jump over *one* marker of the other type into an open square.
- No other types of moves are permitted.

Your Task

The reason that this is a *set* of puzzles is that you can vary the number of markers. Your POW is to investigate this set of puzzles. Begin with the example above, and answer these questions.

1. Can the puzzle be solved? If so, can you find more than one solution?
2. If the puzzle can be solved, how many moves are required? Is there a minimum? Can you prove your answer?

Continued on next page

Once you have answered these questions for the case in which there are three markers of each type, look at other examples. Consider only cases in which the numbers of each type are equal and there is exactly one empty square in the middle. (The supplemental problem *Shuttling Variations* examines other cases.)

Here are some things you can do.

- Find out if all such puzzles have solutions, and if so, how many moves are required.
- Look for a rule that describes the minimum number of moves in terms of the number of markers.
- Prove your results.

Write-up

1. *Problem Statement*
2. *Process*: Describe how you investigated this set of puzzles. Which cases did you examine? Did you try to develop any general conclusions?
3. *Conclusions and Conjectures*: State the questions you investigated and the conclusions you reached. Include questions that you did not have time to investigate. Some of your conclusions may be about specific cases while others may be general.

If you can prove any of your conclusions, include the proofs. If any of your conclusions are still tentative, label them as conjectures.

4. *Evaluation*
5. *Self-assessment*

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HINT: TO FIND THE "RULE" SET UP AN IN/OUT TABLE

(x) # OF PEGS	(y) # of moves

Note: # of PEGS IS REPRESENTS EACH COLOR. I.e. IF THERE IS ONE RED & ONE BLUE THEN # of PEGS IS ONE NOT TWO.