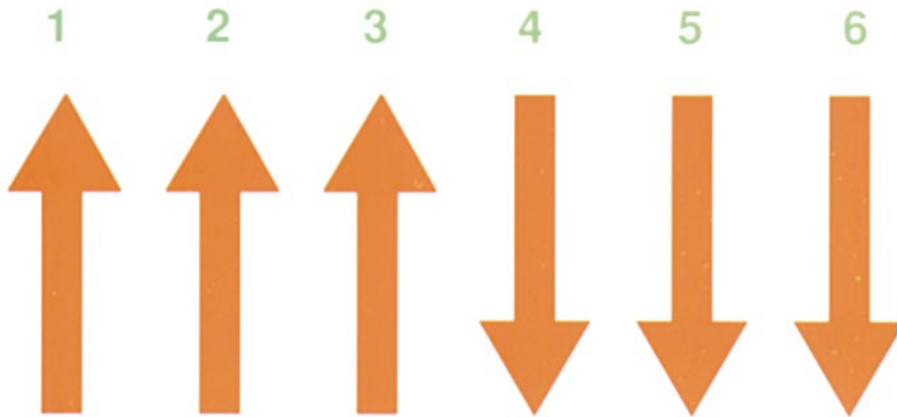


### The Problem

In a row of six arrows, the left three are pointing up and the right three are pointing down. You are to use the minimum number of moves to change the arrows into an alternating sequence. In the final arrangement, the first, third, and fifth arrows will point up; the other arrows will point down. A “move” consists of reversing the directions of two adjacent arrows. Note that you cannot invert one arrow at a time, and that the two arrows you invert must be next to each other.



### Strategies and Hints

1. There are only five possible actions you can take in any one move. Describe these actions.
2. The notation  $R(a, b)$  might be used to describe a move. For example,  $R(1, 2)$  would mean that you invert arrows 1 and 2. The operation  $R$  of reversing two adjacent arrows is commutative. Show that  $R(3, 4)$  followed by  $R(5, 6)$  is the same as  $R(5, 6)$  followed by  $R(3, 4)$ .
3. It would appear that changing the direction of arrow 1 or arrow 6 will not help towards the solution. Why?
4. The problem can be solved with three moves. There are six different solutions.