Jaap's Puzzle Page

Pakoválec

Pakoválec is a recent Czech puzzle, its name roughly translating as 'Stupid Cylinder'. This cleverly designed puzzle consists of a long vertical cylinder inside a shorter transparent tube. Captured between the two are 16 coloured pieces, lying in four vertical columns, held in place by vertical grooves in the inner cylinder. There is also a horizontal groove going around the cylinder, which contains a ring of eight pieces - one piece from each column as well as four more pieces of the same colour as the cylinder. When you rotate the outer tube, the ring of eight pieces are rotated too, and when you shift the outer tube up or down, it is the four columns that are shifted. When solved, the each column has a different colour (red, blue, green, yellow). Note that four columns are not evenly spaced - two are adjacent, right next to an extra wide gap before the next column.

This puzzle is of an extremely simple but effective design. The horizontal groove has a long spring underneath the pieces, wrapped around the cylinder. This spring pushes the eight pieces outwards against the outer tube, so that when the tube is rotated these pieces are dragged along by friction. This same spring is responsible for the clicking action that occurs when the tube is shifted up or down. The pieces have horizontal grooves on their underside, so they nestle onto the spring with a satisfying feel. The only disadvantage of this simple design is that excessive play will cause some scratching of the outer tube.

If your browser supports JavaScript, then you can play Pakoválec by clicking the link below:
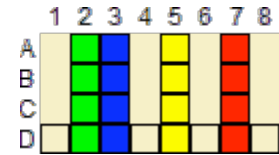
JavaScript Pakoválec

The number of positions:
There are 20 pieces, giving a maximum of 20! positions. This limit is not reached because:

- There are five sets of 4 indistinguishable pieces ($4!^5$)
- Four of the colours are equivalent (4!)

This leaves $20!/(4!^6) = 12,730,843,125$ positions.

Solution:

The solution below assumes you hold the tube with the adjacent columns at the front, and the other columns to the right and back. The big gap between columns is on the left. To make it easier to describe, I will number the columns and gaps from left to right, so the columns get the numbers 2, 3, 5 and 7. The diagram on the right illustrates this. The four rows are labelled from A at the top to D at the bottom.
Important: To keep this labelling consistent, never rotate the inner cylinder, but only move the outer tube.

Phase 1: Solve the top row, row A

a. Do any moves to bring a red piece at position A3 (i.e. on row A, column 3)
b. Without disturbing the previous red piece, bring any yellow piece to column 1.
c. Shift the yellow piece up to row A, and then right to column 3. This puts the previously placed red piece in column 5.
d. Without disturbing the previous two pieces, bring any green piece to column 1.
e. Shift the green piece up to row A, and then right to column 3. This puts the previous red piece in column 7, and the yellow piece in column 5.
f. Without disturbing the previous three pieces, bring any blue piece to position B2, i.e. to the left and below the green piece.
g. Move the green piece left twice (to column 1), down (next to the blue), left, up, right twice.
h. You have now placed green, blue, yellow, and red in columns 2, 3, 5, and 7 respectively of row A.

Phase 2: Solve rows B and C.
The next two rows can be solved in exactly the same way as row A. You will never have to disturb the previously solved row(s).

Phase 3: Solve the last row, row D.
Instead of laying out explicit steps for each piece, I will give a few easy move sequences that make small changes in row D. By applying these sequences freely you can solve the last row much more easily than any rigidly defined set of steps.

a. To swap pieces D4 and D6:
   1. Shift row A right two steps.
   2. Shift row B right two steps.
   3. Shift row C right two steps.
   4. Shift row B left two steps.
   5. Shift row C left two steps.
   6. Shift row A right two steps.
   With this sequence you can swap any two pieces on row D which have one piece between them.
   Just shift them to D4 and D6, do the sequence, and shift row D back again.
b. To swap pieces D1 and D6:
   1. Shift row A right three steps.
   2. Shift row B right three steps.
   3. Shift row C right three steps.
   4. Shift row B left three steps.
   5. Shift row C left three steps.
   6. Shift row A right three steps.
   With this sequence you can swap any two pieces on row D which have two pieces between them.
   Just shift them to D1 and D6, do the sequence, and shift row D back again.
c. To cycle pieces D7 to D8 to D1
   1. Shift row B left.
   2. Shift row D right, C right, D left.
   3. Shift row B right.
   4. Shift row D right, C left, D left.

With this sequence you can swap any three adjacent pieces on row D. Just shift them to D7, D8, and D1, do the sequence, and shift row D back again.

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