

Jaap's Puzzle Page

Rubik's Rabbits



Rubik's Rabbits is a puzzle in the shape of a top hat. The hat is divided into 6 discs, which can rotate. You can look inside the hat, and see that the discs are divided into 9 segments, each of which may or may not show a rabbit when held up to the light. The aim is to turn the discs such that all nine rabbits are visible. On the outside the discs are marked with one letter each, so that their positions are clearly visible. The letters spell out *RUBIK, with the * on the rim of the hat. In the initial position when all the letters are lined up there are no rabbits visible.

The top of the hat is coloured, so that when solved the 9 visible rabbits alternate in the colours yellow, green and red. For an extra challenge you could try to get a position where only three rabbits of the same colour are visible, or where 6 rabbits are visible of only two colours.

The number of positions:

If you consider the rim of the hat fixed, then the other 5 discs can each be in any of the 9 possible positions. There are therefore only $9^5 = 59,049$ positions. There is only one solution.

Hints for solution:

- Each disc has empty segments, as well as segments with a polarized filter.
- The polarized filters come in two types. If both types occur in a segment of the hat, then no rabbit is visible there.
- Each disc has exactly three filters, all of the same type.
- The *, R and I discs have filters of one type, the U, B and K discs have filters of the other type.
- You can see when there are no filters at all in a segment of the hat, as the rabbit will be of a bright colour. If there are one or more filters of the same type, then the rabbit will be less bright. This does not give you any indication of how many filters are in that segment, or of which type, just that there is one or more of only one type.

Solution:

The segments of the discs are traced out in the following table. The X and O mark the two types of polarized filters. This is the initial position. As each column has an X and an O, no segment shows a rabbit.

*							X		X	X	
R	X							X			X
U							O		O		O
B	O			O	O						
I			X	X	X						
K			O					O			O

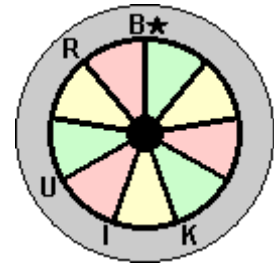
Note that the starting position is not the only one that shows no rabbits. You can rotate the three discs UBK as a whole any amount relative to the *RI discs, and still no rabbits would show.

The unique solved position is shown in this table. Each column has only X's or only O's.

	X			X	X		*				
	X				X	R	X				
			O	U					O		O
							B	O		O	O
		I		X	X	X					
K		O						O			O

Here is the solution described in words:

- Hold the hat sideways, so that the word *RUBIK is the right way up.
- Turn the R ring downwards, i.e. so that the R is one segment below the *.
- Turn the U ring downwards three segments relative to the *.
- Leave the B ring as it is, on the same level as the *.
- Turn the I ring downwards four segments relative to the *.
- Turn the K ring downwards five segments relative to the * (or 4 segments upwards).
- All 9 rabbits should now be visible.



Here are solutions to the extra challenges. There are only 16, 184 and 8 solutions for three green, yellow, or red rabbits respectively.

*							X		X	X	
					X				X	R	X
				O			O		O	U	
B	O			O	O						
	X		X							I	X
K			O						O		O

		*							X		X	X
			X	R	X						X	
			O	U						O		O
				B	O			O	O			
				I		X	X	X				
K			O						O		O	

						X			X	X		*
R	X								X			X
			O	U						O		O
B	O				O	O						
		I			X	X	X					
K			O						O		O	

There are 33, 133 and 2 solutions for red & yellow, yellow & green, or red & green rabbits respectively.

						X			X	X		*
				X	R	X						X
	O			O	U						O	
		O		O							B	O
					I		X	X	X			
K			O						O		O	

*								X		X	X		
								X			X	R	X
						O			O		O	U	
		B	O			O	O						
	X	X	X									I	
K			O						O		O		

	X			*						X		X
					X	R	X					X
	O	U							O		O	
					B	O			O	O		
		I			X	X	X					

K			O						O			O		
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