CURVED NONOGRAMS

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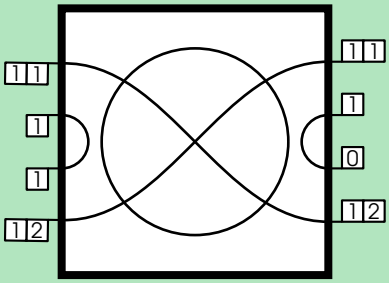
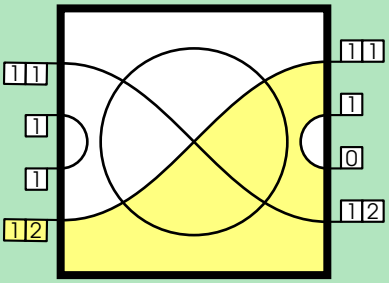
BASIC RULES

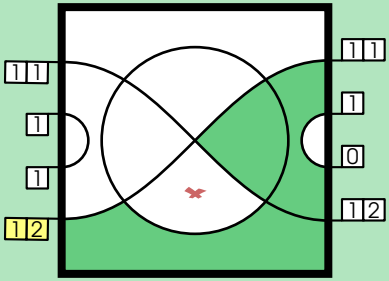
A curved nonogram puzzle consists of a box, divided into *cells* by a set of *curves*. Each cell of a puzzle must either be *filled* or remain *empty*, to reveal a hidden image.

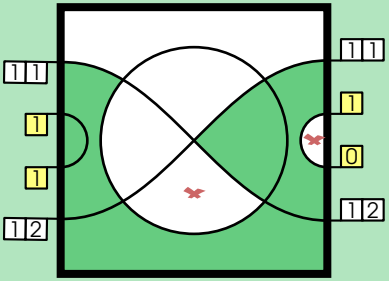




Clues outside the puzzle tell us how many *consecutive* cells touching a curve must be filled. The clue in the bottom left corresponds to all cells touching the curve from below.

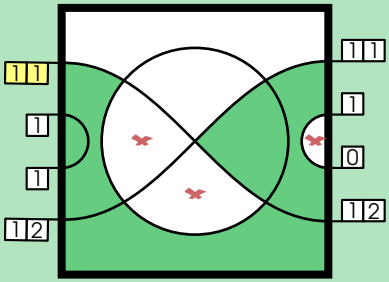
The clue tells us there must be one cell filled, at least one cell empty, and another two cells filled. Since there are four cells in the sequence, there is only one way to do this.

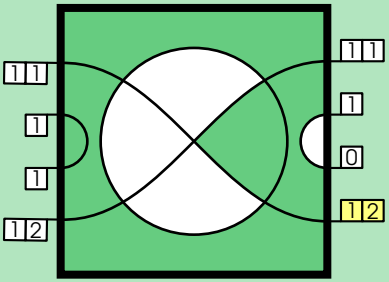




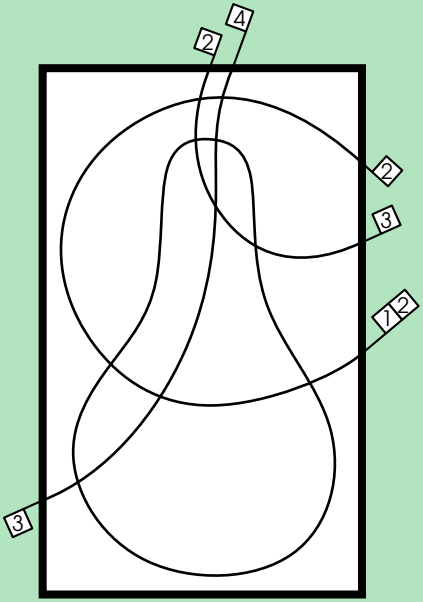
In this puzzle, there are four single clues, all belonging to only a single cell. Three of them are ones and one is a zero, so we can fill in three cells and mark the fourth as empty.

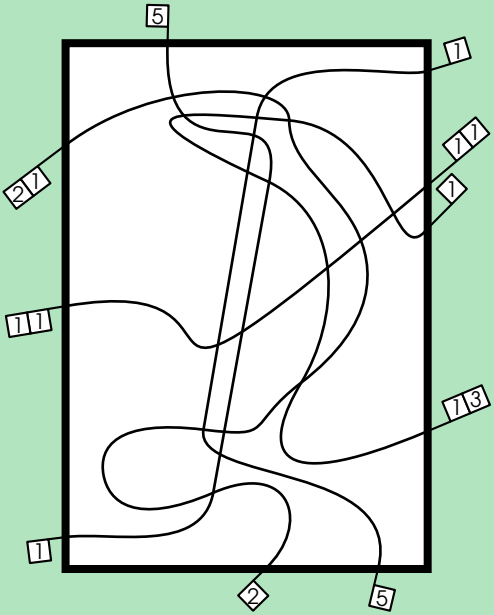
We now look at the clue at the top left. It tells us there should be two single cells filled in. Since we already filled two cells, both cells in the middle must be empty.

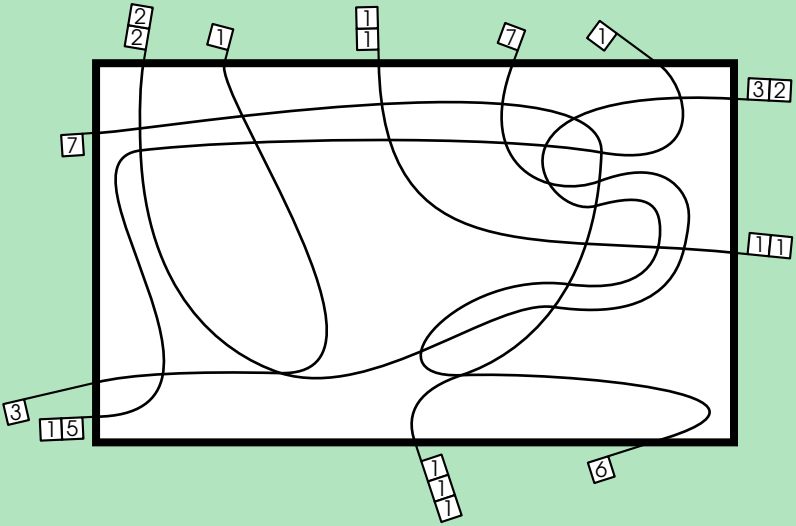


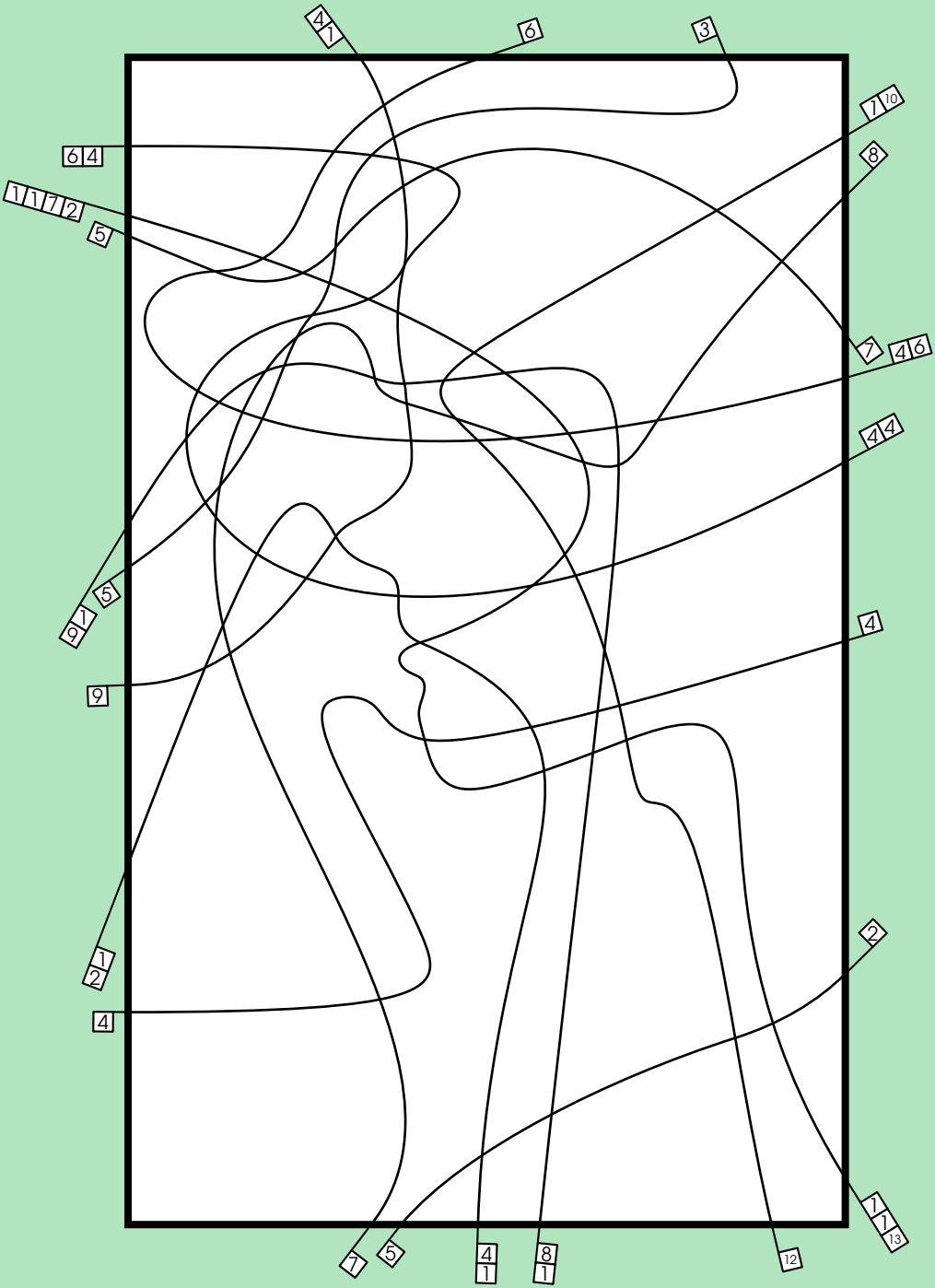


Finally, we finish the puzzle by looking at the bottom right clue: two cells are already filled, and the third one must be separated from them by an empty cell.


4
2
2
3
12
3

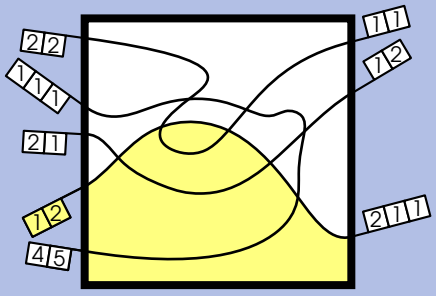

5
1
11
21
1
11
13
1
2
5

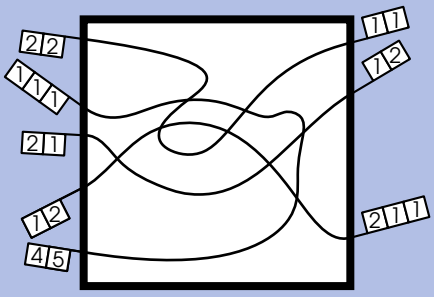

22
1
11
7
1
32
7
11
3
15
111
6


41
6
3
710
64
8
1172
5
746
44
5
91
9
4
12
4
2
7
5
41
81
12
113

ADVANCED RULES

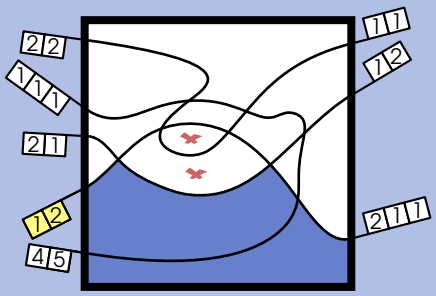
So far, the sequences of cells touching a curve have been pretty clear. In general, curves can touch the *same* cell multiple times.

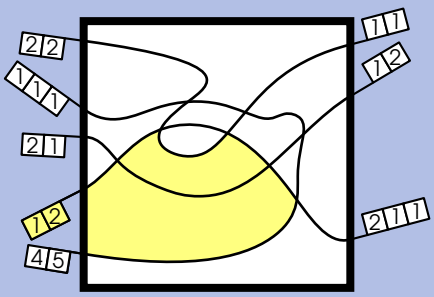




The fourth clue on the left tells us there must be one and two cells filled touching the curve from below, separated by at least one empty cell. There are four such cells.

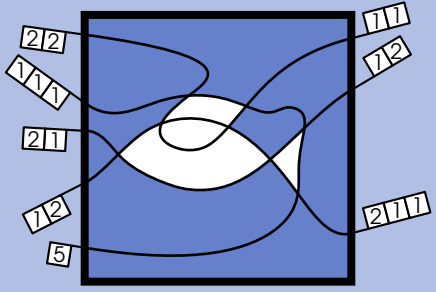
Two of these cells touch the curve *twice*! These cells appear multiple times in the sequence: the clue tells us there are one and two cells filled in a sequence of length *six*.

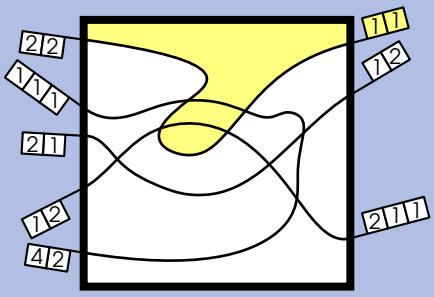




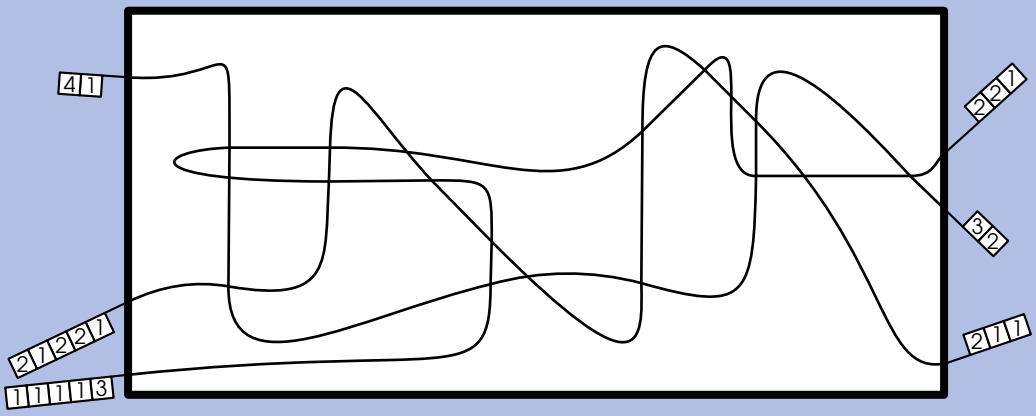
Trying all possible ways to fill the cells reveals that there is only one way compatible with the clue, filling only *two* of the four cells. One cell is part of both the 1 and the 2 in the clue!

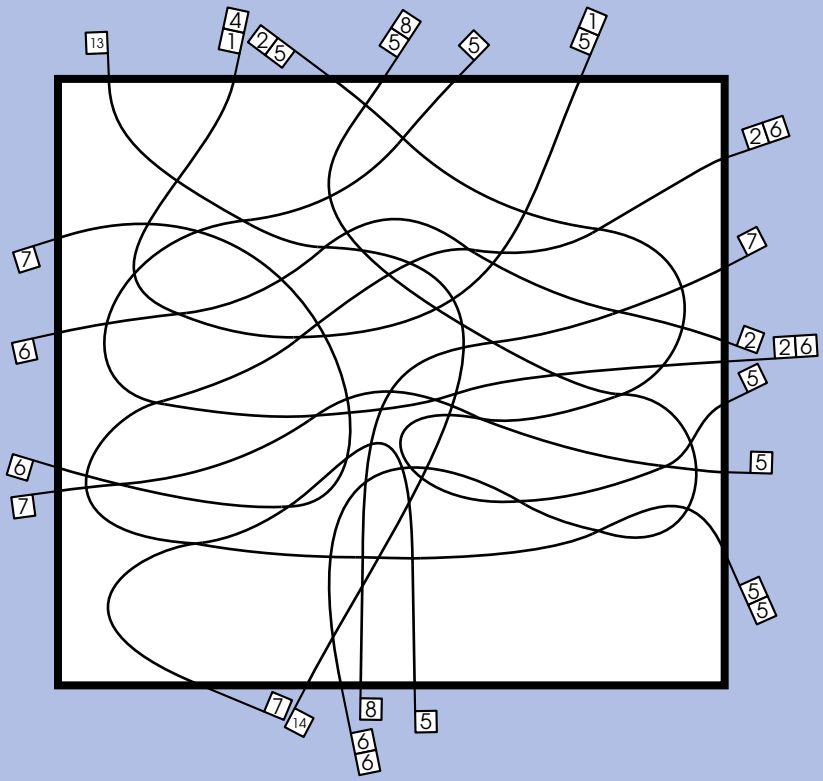
The same happens at the top right. The clue refers to a sequence length *five*, using the *three* cells that touch the curve from above. This time, there are two compatible fillings!

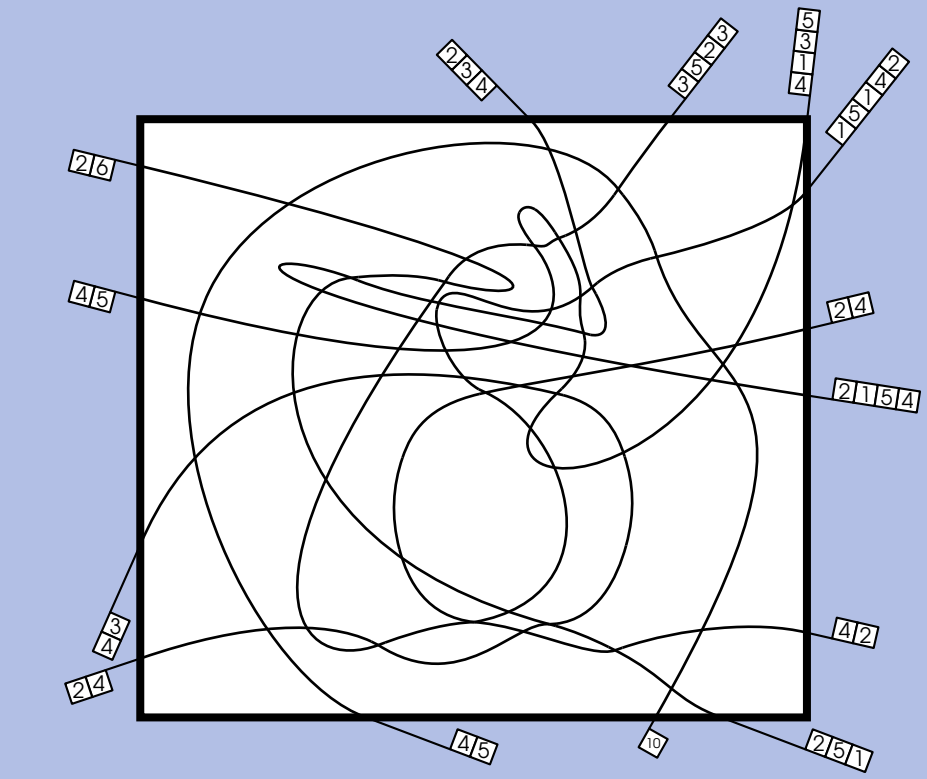


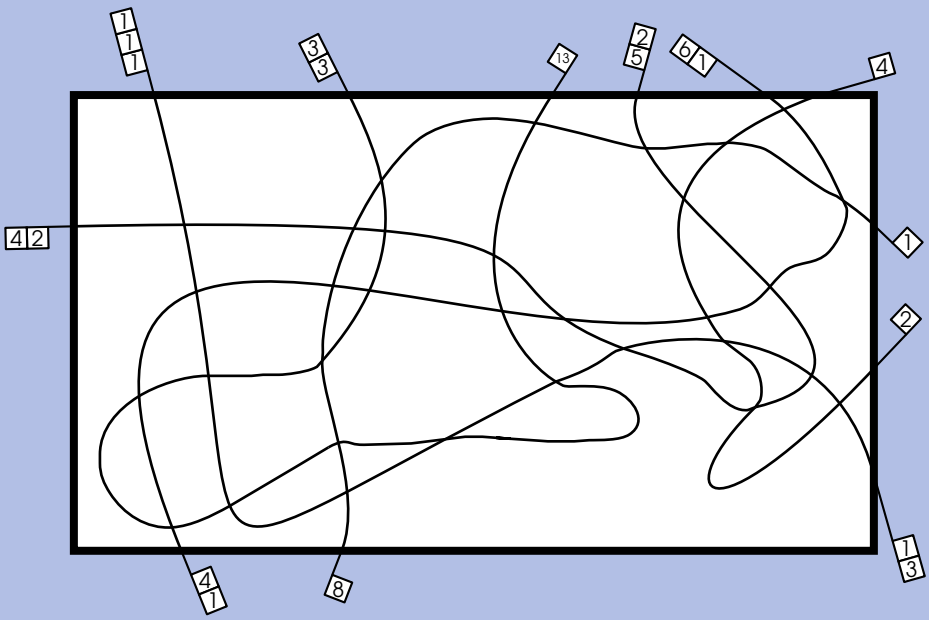


Although cells can touch a curve multiple times, they always touch the curve on the *same* sides. Each cell can be counted in only one of the two clues of a curve.


4 1
2 2 1
3 2
2 1 1
2 1 2 2 1
1 1 1 1 1 3

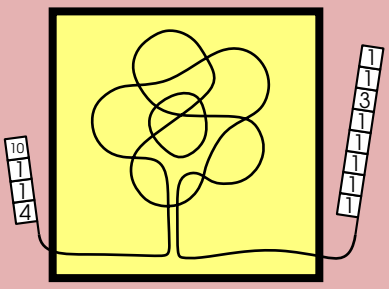

13
4 1
2 5
8 5
5
1 5
2 6
7
7
6
2
2 6
5
6
5
7
5 5
7 14
8
5
6 6

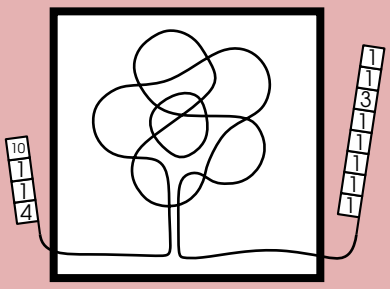

2 3 4
3 5 2 3
5 3 1 4
1 5 1 4 2
2 6
4 5
2 4
2 1 5 4
3 4
2 4
4 2
4 5
10
2 5 1


1 1 1
3 3
13
2 5
6 1
4
4 2
1
2
1 3
4 1
8

EXPERT RULES

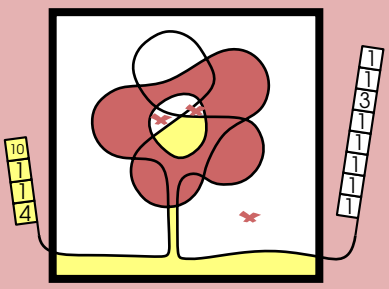
In their most general shape, curves can have *self-intersections*. In this case, there will also be cells that touch the same curve multiple times, and sometimes on *opposite* sides.

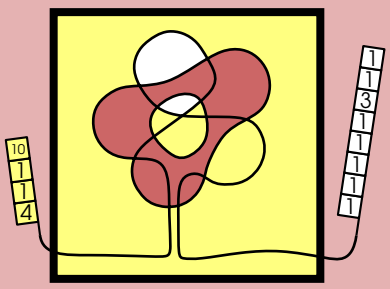




This puzzle has only two clues. Each clue corresponds to a sequence of *twenty-one* cells, even though there are only fourteen cells in the puzzle in total.

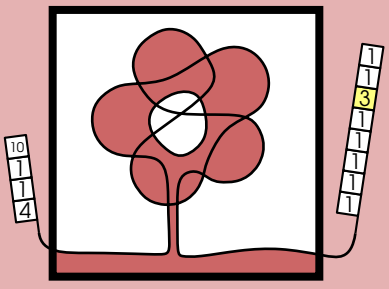
The left clue gives information about all but two cells. We know nineteen cells are required to fulfill the clue, so at least the third to the tenth cell must be filled.

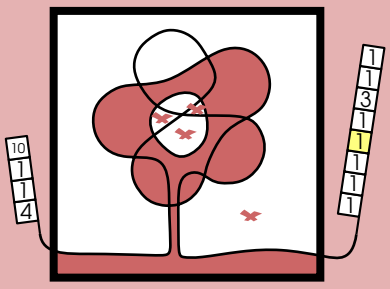




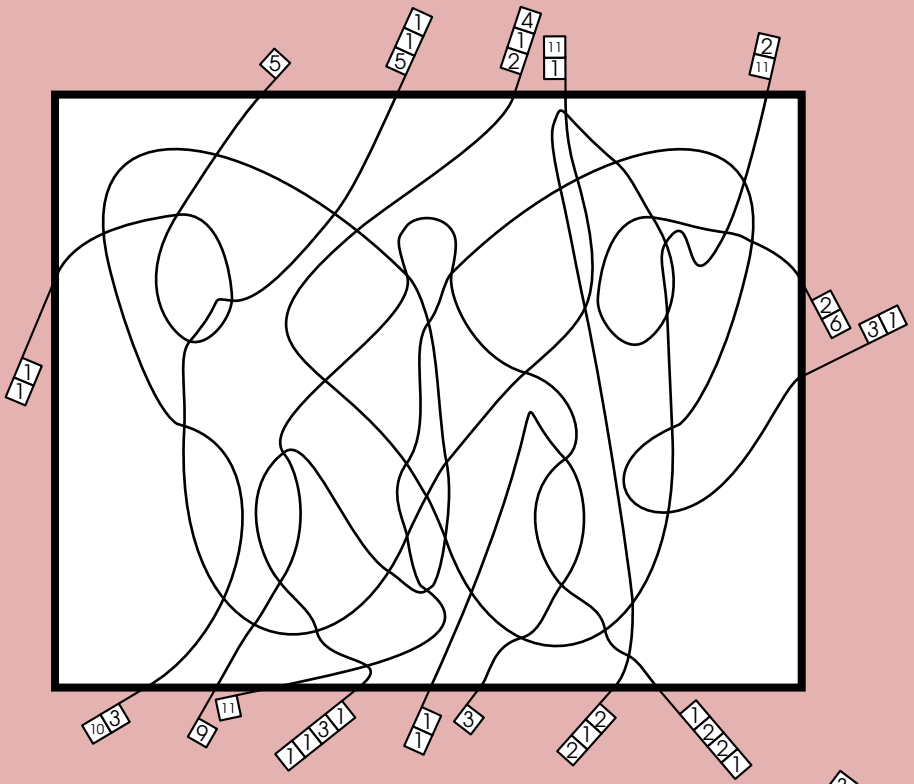
However, because of repeated cells, by doing this we also already filled the *second* cell of the sequence! We can mark three cells as empty and fill one more cell.

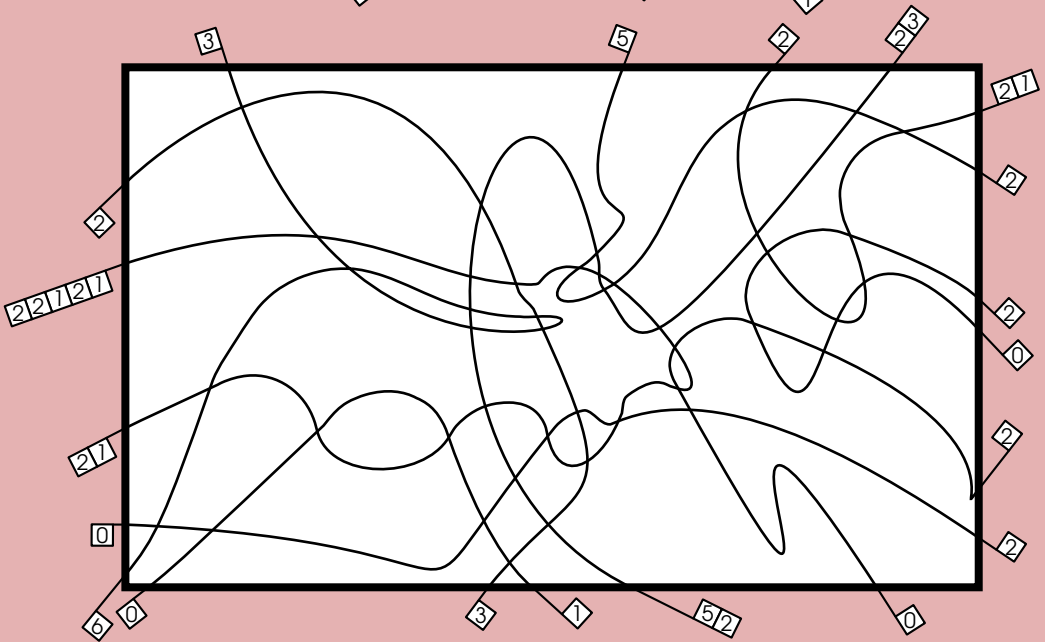
Two cells remained undertermined. Using the information in the right clue, we have to fill the bottom cell: the other cell does not touch the curve from the correct side.

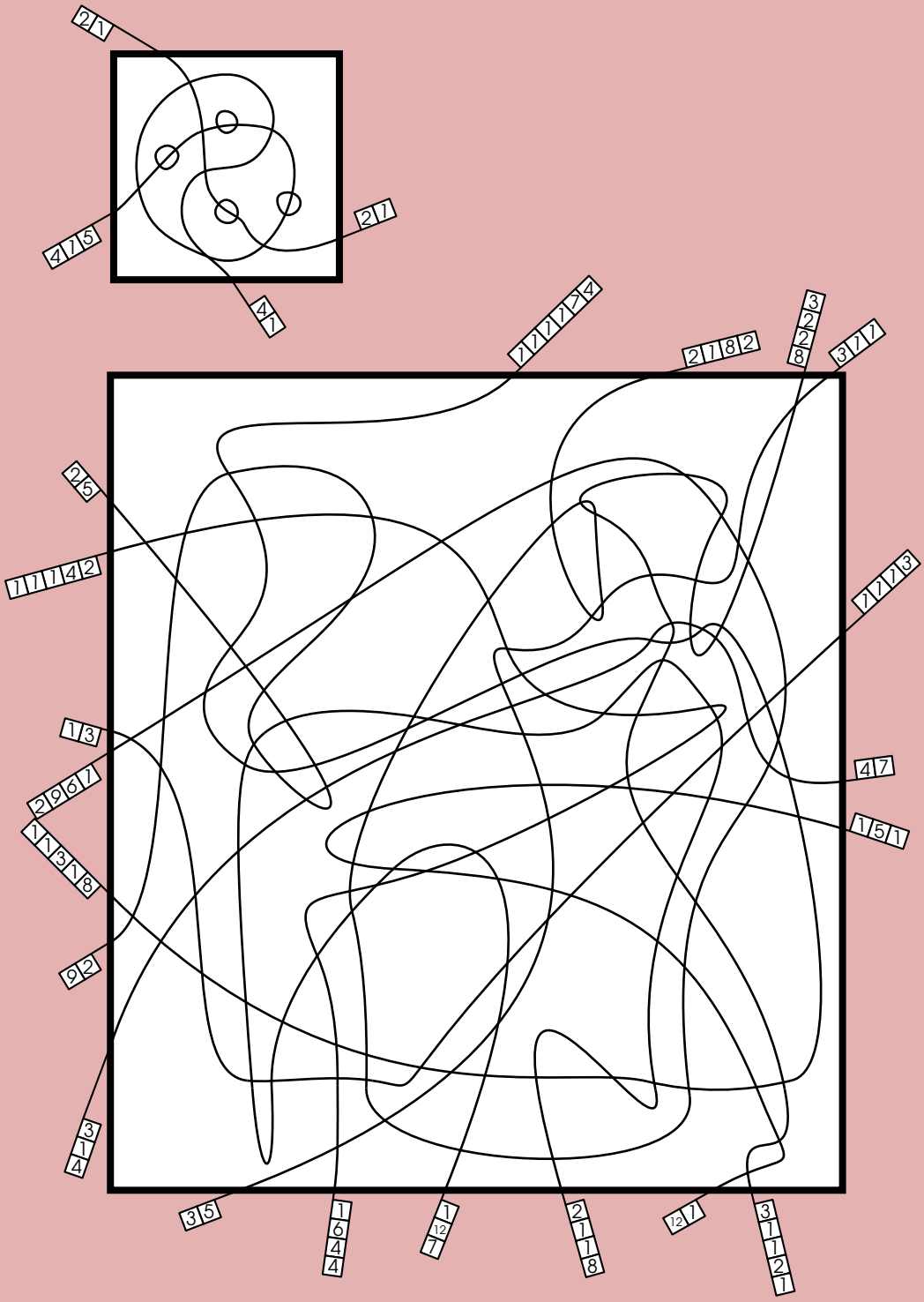




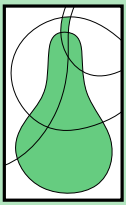
Finally, the three tells us that the top petal must be filled, since the other cell appears twice in the sequence. Understanding the sequences is key to solving the puzzle!

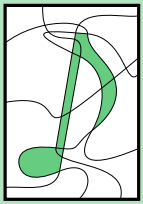


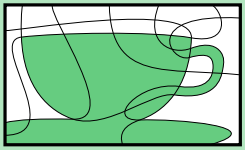


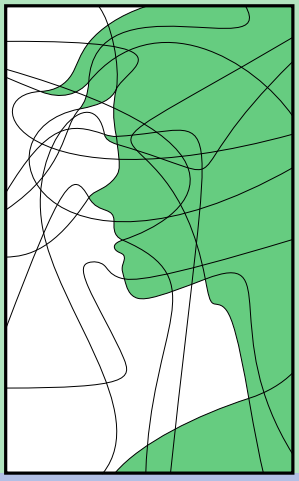


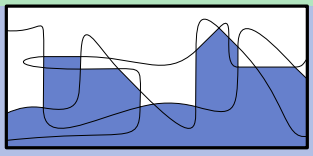
SOLUTIONS

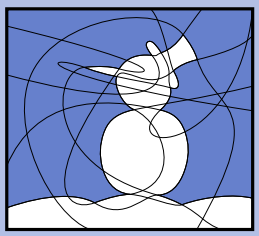


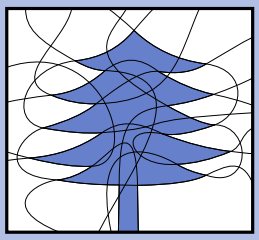


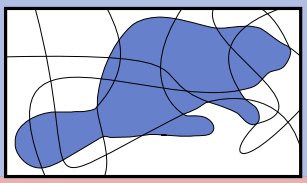


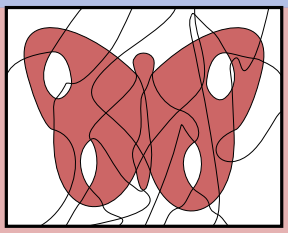


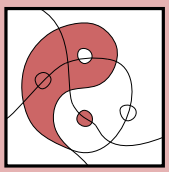


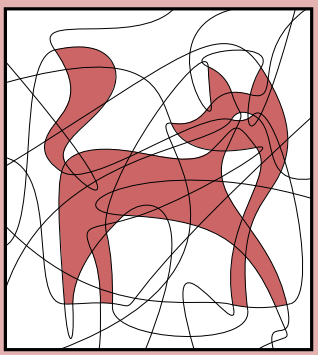


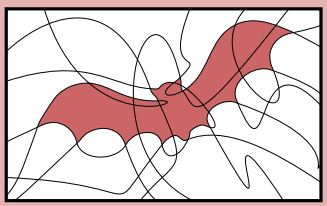


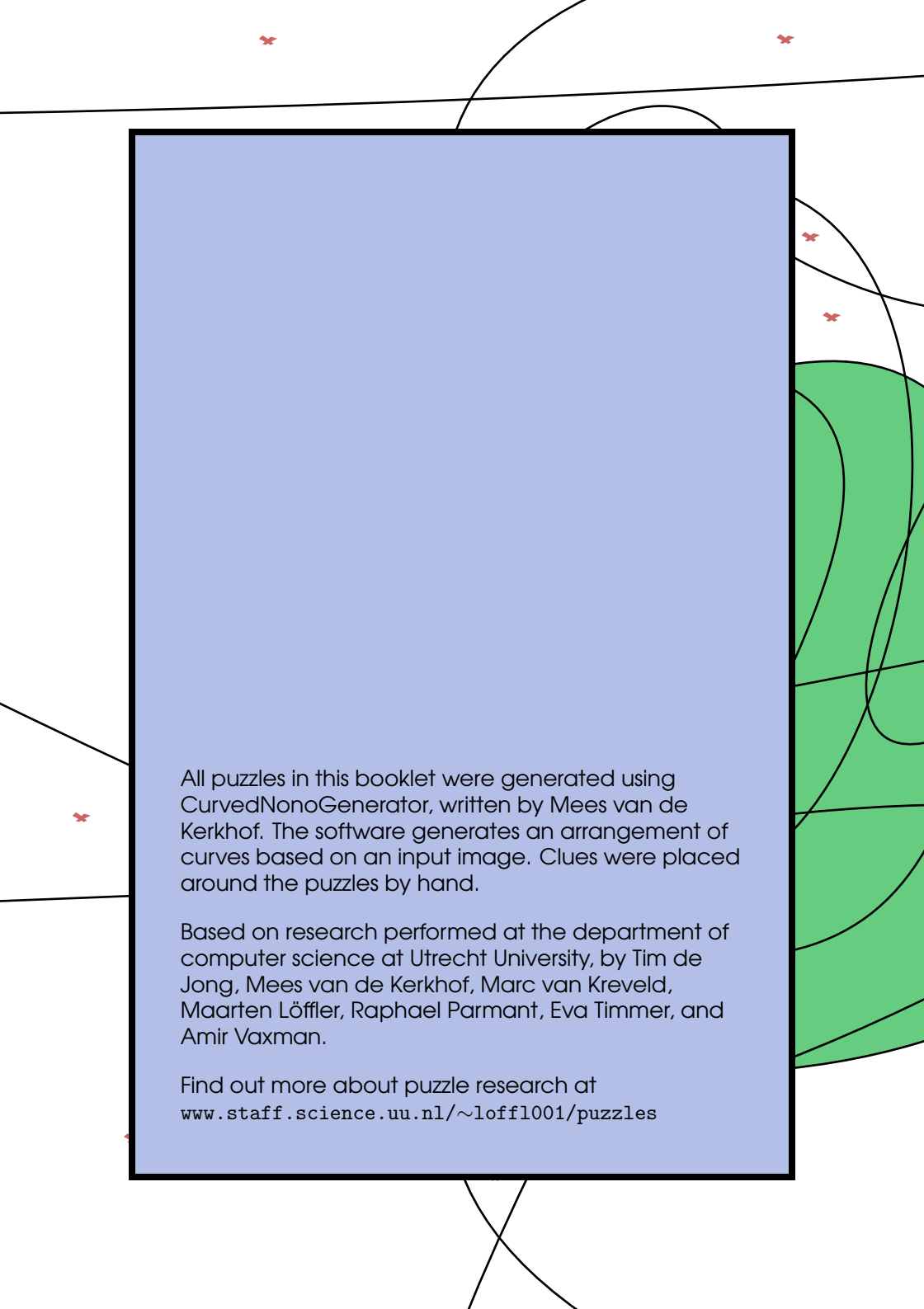












All puzzles in this booklet were generated using CurvedNonoGenerator, written by Mees van de Kerkhof. The software generates an arrangement of curves based on an input image. Clues were placed around the puzzles by hand.

Based on research performed at the department of computer science at Utrecht University, by Tim de Jong, Mees van de Kerkhof, Marc van Kreveld, Maarten Löffler, Raphael Parmant, Eva Timmer, and Amir Vaxman.

Find out more about puzzle research at
`www.staff.science.uu.nl/~loffl001/puzzles`