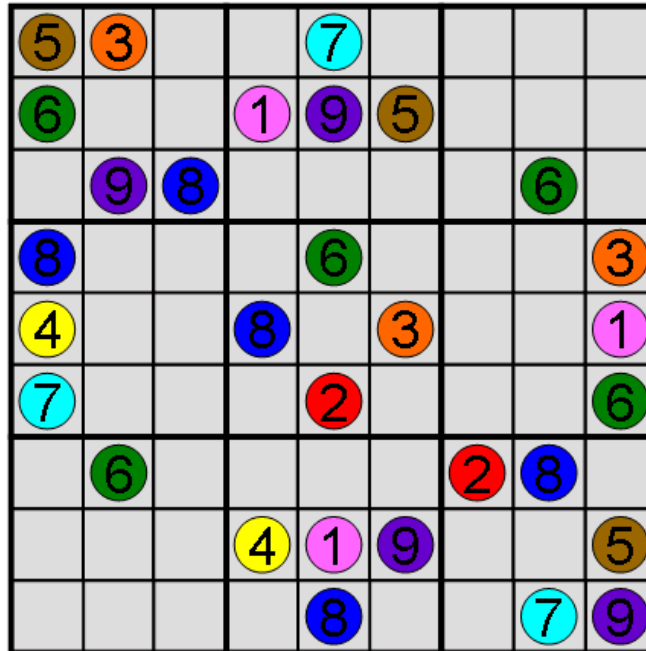
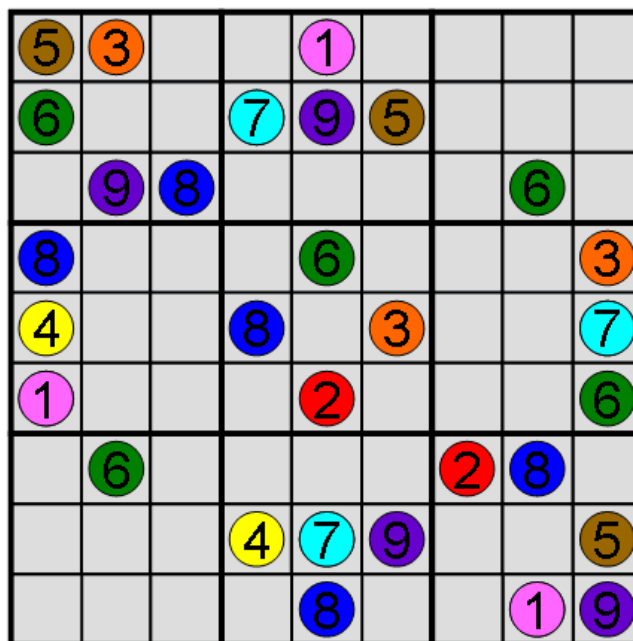


Mini Sudoku

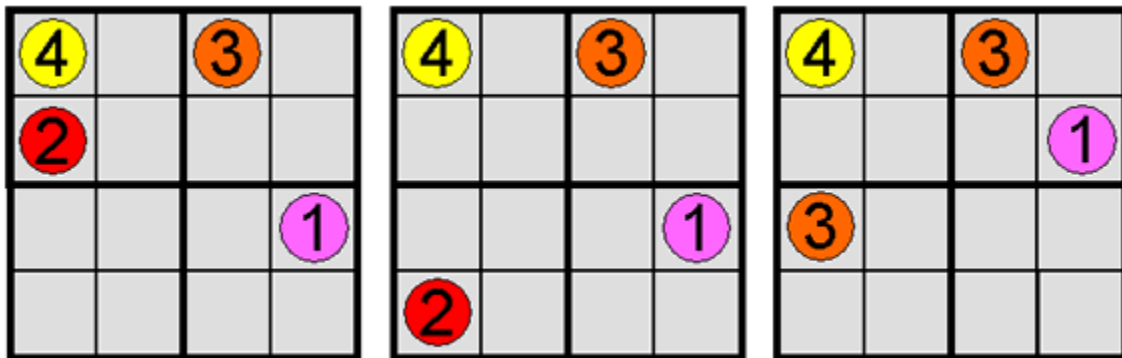
The newest puzzle craze, Sudoku, requires you to add numbers to a grid so that every row and every column and every 3x3 bold square has got one of each number 1 through 9. Here is a sample to solve:



How would the solution to the above Sudoku compare with one in which the original position of the 1s and 7s are swapped?

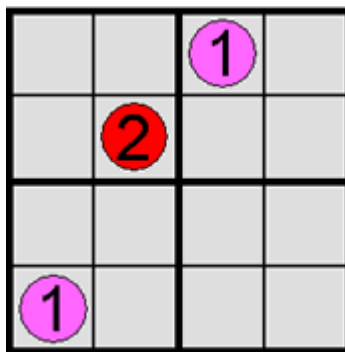


These big Sudoku are too large to solve in a math fair. Here are three Mini-Sudoku. A Mini-Sudoku uses digits 1 through 4. Each row, column and 2x2 bold square must contain one of each digit. Usually each Sudoku has exactly one solution, but that might not be true for these Mini-Sudoku. How many solutions does each one have?

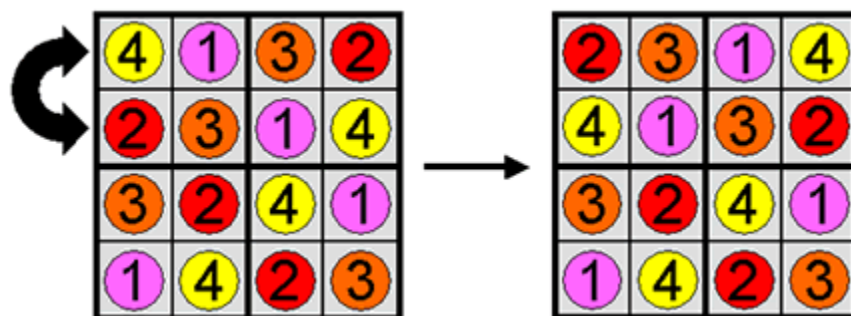


Extensions:

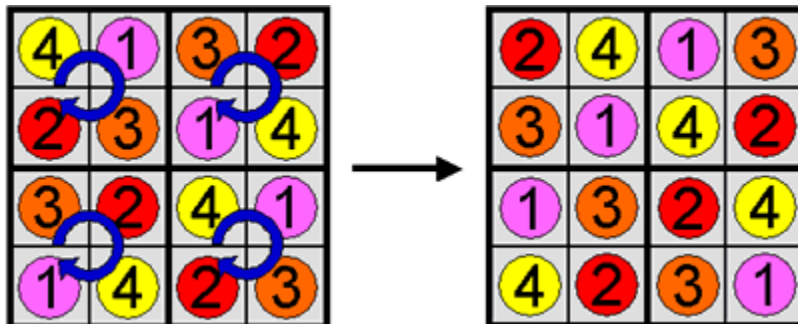
- Create your own mini-Sudoku on a 4 by 4 grid.
- Rachael and Sydney from Bishop Pinkham ask how many solutions this mini-Sudoku has:



- When all of the squares are correctly filled in a mini-Sudoku, is it always possible to flip the first two rows and still have the mini-Sudoku correctly filled? For example:



- When all of the squares are correctly filled in a mini-Sudoku, is it always possible to rotate the numbers in each of the four corner squares by 90 degrees clockwise and still have the mini-Sudoku correctly filled? For example:



- Do these same transformations work on a regularly sized Sudoku?
- What is the minimum number of numbers you can add to the grid in order to guarantee a unique solution?
- What is the maximum number of numbers you can add to a grid in order that there are at least two solutions?
- The Sudoku below has already been solved. Notice that the numbers are symmetrically distributed so that if you rotated the Sudoku clockwise by 90 degrees, you could replace 1s with 4s, the 4s with 2s, the 2s with 3s and the 3s with 1s. Are there different types of Sudoku symmetries?

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

- Can you create a full sized Sudoku that has a unique solution and only 16 numbers filled in? **Warning:** This is an unsolved problem in mathematics. See [Minimum Sudoku](#).

The Math in This Problem:

Using digits 1 through 4, Mini Sudoku serves as a simplified version to the classic Sudoku game to be solved in math fairs. Progressing through these math puzzles will require students to practice mathematical analysis, focusing on counting possible solutions given initial values presented on the grid.