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Math 3096

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### Designing a Logic Puzzle: "Gridlock"

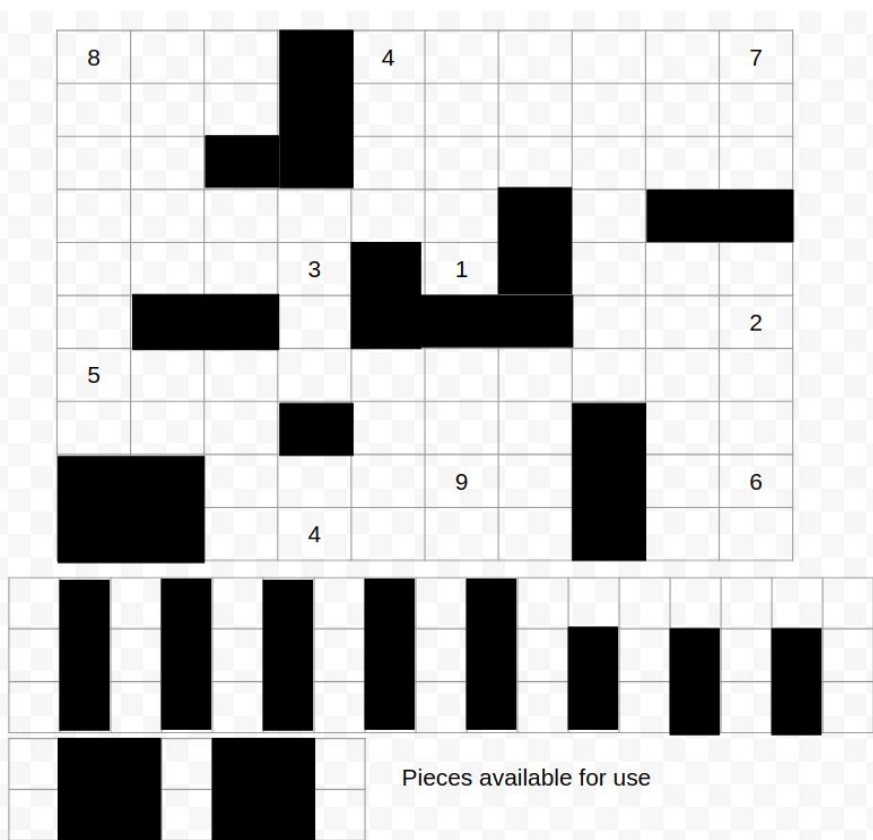
The design of this game involved inspiration from a number of places. The first was the variety of games that were explored in the classroom. From there came the basis of the grid, as well as the idea for the count of squares that are blocked off to equal the number that they enclose on the grid. The third major portion of this game, the use of pre-defined shapes to create the enclosed spaces for counting, came from a board game called Cathedral. This game involves competition between two players, each of them playing tetris-like shapes on a grid board to attempt to enclose the most space. From these inspirations, the basis of the game was set, and fiddling and fine-tuning began, with the majority of the process simply being trial and error. The original idea for the game designed here was to use a larger variety of shapes than the current version uses, somewhat similar to a tetris variety, but the more complex shapes unfortunately presented issues with maintaining a unique solution to the game, requiring it to be scrapped. Another initial idea that was scrapped was that the board would be completely empty, with only numbers as 'hints', to begin the game. Like the variety of shapes idea, this rule also presented lots of issues with unique solutions, and due to the much larger number of pieces needed, seemed like it would make the game more tedious.

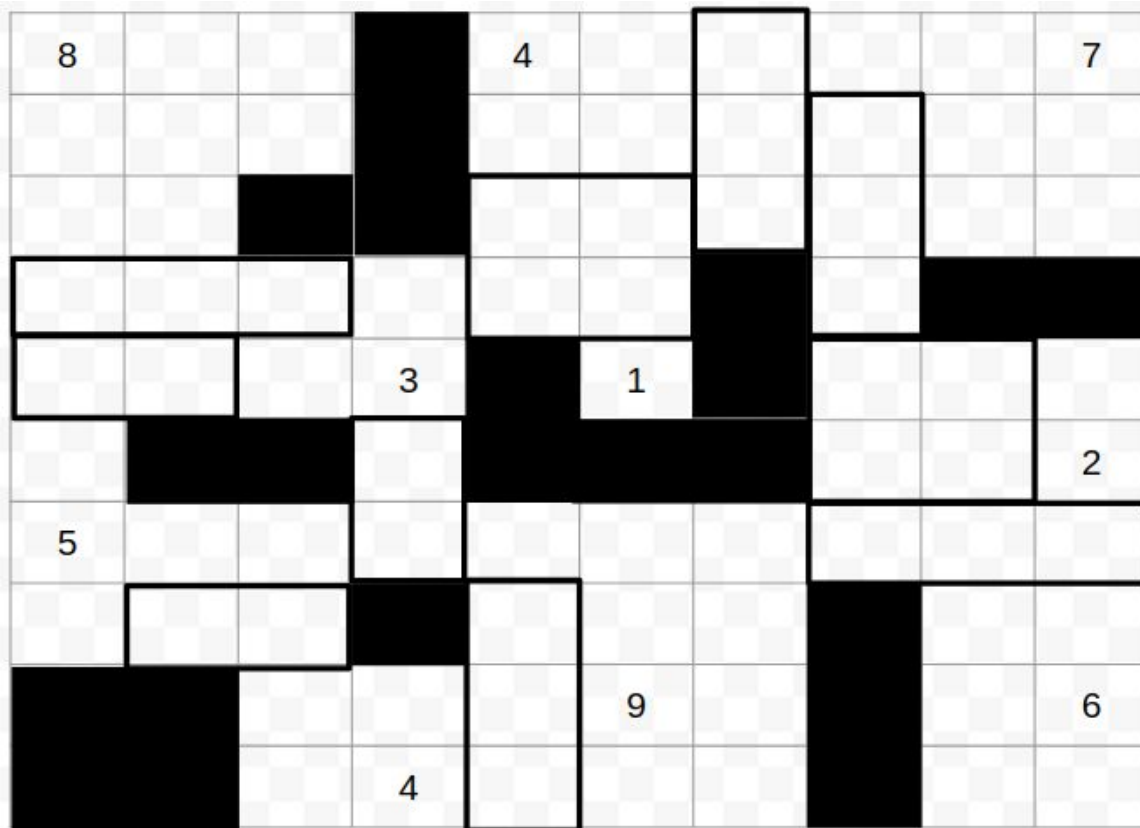
From this process, Gridlock was created. The game is played on a 10x10 grid, and the goal is to create white spaces encompassing one number each, with each white space holding the number of squares denoted by its number. The full rules are detailed below.

1. Solving the puzzle is done through placing the shapes allotted to the player onto the playing grid, or board.

2. The hints on the board are comprised of existing black spaces, and numbers in some of the white spaces.
3. The goal is to enclose each number in an area that contains the number of white spaces which the number denotes.
4. No enclosed white space area can contain two numbers.
5. Full enclosure includes the corners. (i.e. white space should not touch corner to corner)
6. Black squares cannot be connected only corner to corner. They are permitted to touch corner to corner if another piece fills one of the white spaces on the opposite diagonal.
7. All black spaces must be connected; There cannot be any 'islands' of black space.
8. All pieces provided to the player must be used.

Based on these rules, here is an example of a puzzle to be solved, along with its solution. Below the images, how the puzzles were designed is explained.





Note: All NxN references are rows by columns

Design of this puzzle began in the bottom right corner of the board. To begin, the 6 number hint was placed. Then, the 3 high block to its left was placed in order to constrain the player into having the 6 go up. Next, the 2 number hint was placed. This was done to prevent the player from attempting to enclose a 6x1 space, and force the 3x2 space seen in the key. Next, The 1x2 block above the 2 was placed to constrain the area for the 2, as well as provide a boundary for the next hint, the 7 above it. Then, the 6 square black shape in the center was placed. Its shape was adjusted a few times through the course of the puzzle design, but this is when it began. Up next were the 4, the 1, and the 4 square bounding block to the left of the number 4. Knowing that the 1 will need to be completely closed off, with the two squares above it needing occupied, and the 7 needing its form finished, the player can deduce the use of the 2x2 and 3x1 to finish those boxes. Next were the 8 and the 3 hints, accompanied by the 2

square black box near the 3. Based on the starting shape next to the 4, the 8 must essentially just be closed off. This creates two possible shapes for the 3 space to have. That choice was constrained using the size one black block two spaces below the 3. After this, the rest of the clues were placed in parallel in order to finish off the board. The 5 clue near the 3 requires the closing of the gap to the left of the 3, and the 4 clue combined with the 2x2 starting block next to it constrain the 9 into not being a 3x3 block.

Overall, this example may be on the harder end of a designed puzzle of these rules, as it may require some inference and thinking ahead. However, that is hard assumption to back 100%, as it is not a widely tested game. All of that being said, hopefully it is at least fun.