

Project Specification: Rules of the Game of Slider

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Board

Our game of Slider is played on an $N \times N$ square board, which comprises N^2 squares known as *cells* or *positions*. We number board positions using the notation (row, column), where (0,0) corresponds to the bottom-left position, and ($N-1$, $N-1$) corresponds to the top-right position, i.e., row indices decrease as we move down the board, while column indices increase as we move to the right.

Each cell can have up to 4 *adjacent* cells that are either vertically or horizontally adjacent (e.g., (1,1) has the adjacent cells (0,1), (1,0), (1,2), and (2,1), whereas (0,0) has only 2 adjacent cells).

Players

There are two players named *Vertical* and *Horizontal*. Each player has their own set of pieces that they can control on the board. We will denote a piece for player *Vertical* as *V*, and a piece for player *Horizontal* as *H*.

Example of piece positions

Below is an example of a 6x6 board. It has three H pieces at cells (5,3), (4,2) and (3,2), two V pieces at (4,3) and (0,0), and a blocked at cell (3,4).

			H		
		H	V		
		H			
V					

Figure 1

Objective and rules of the game

The initial state of the game is illustrated below for the case of a 6x6 board. The H pieces start in the top $N-1$ positions of the leftmost column of the board (i.e., in column 0, rows 1 to $N-1$), while the V pieces start in the rightmost $N-1$ positions of the bottom row of the board (i.e., in row 0, column 1 to $N-1$). Additionally, a selection of positions may be chosen at the beginning of the game to be blocked for the duration of the game.

H					
H					
H					
H					
H					
	V	V	V	V	V

Figure 2

A player is chosen arbitrarily to make the first move, and then players take turns at moving one of their pieces. At each move, a player is allowed to move only one piece to an empty cell, i.e., not occupied by another piece or blocked. Player H can move their pieces either up, down, or to the right, but never to the left. Player V can move their pieces either left, right, or up, but never down. A piece can be moved only into an adjacent square, either horizontally or vertically, i.e., a piece cannot be moved more than one square at a time, and cannot move diagonally. For example, in the board shown in Figure 3 below, H can move into any one of the squares marked with an x, while V can move into any one of the squares marked with a y. H pieces are not allowed to cross the top, bottom, or left edges of the board. Similarly, V pieces are not allowed to cross the bottom, left, or right edges of the board.

		x			
		H	x,y		
			V	y	

Figure 3

If a player has no legal moves to make on their turn, then they must pass, forfeiting their turn. Passing is not allowed unless the player has no legal moves. If both players are forced to pass in consecutive turns, then the game ends in a tie.

The objective of each player is to move their pieces off the edge of the board that is opposite their starting position (i.e., the right edge for H and the top edge for V). The first player to achieve this wins the game. For example, in Figure 3, Player V can win if they have the next move and if they move their final piece up for their next 3 moves. If Player H has the next move, H can win by moving their final piece right for their next 4 moves.