Monster Arena

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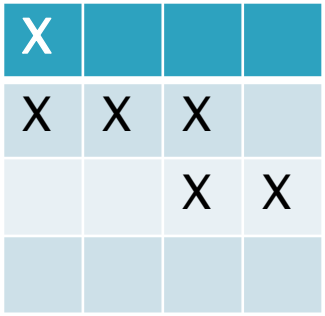
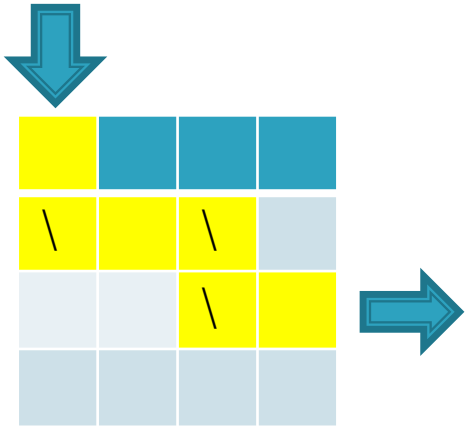
Question

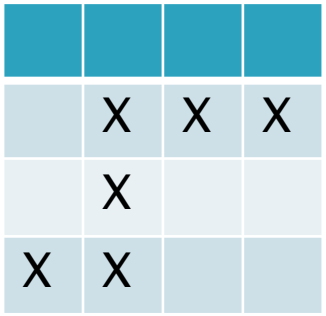
- Given a N * N grid
- A mirror in some cells
- All mirrors are ‘/’ or all are ‘\’

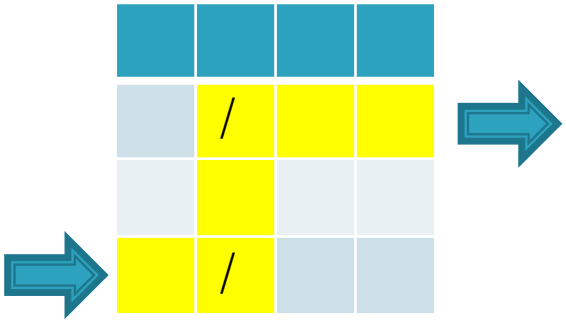
- Every cell is bright or dark
- Bright cells are the path of the light beam
- Given the bright cells, find the positions of mirrors

Question









Solution 1

- Exhaustion

- Assume all mirrors are '/'
- Find every possible configuration of mirrors
- Check whether the path satisfies the configuration

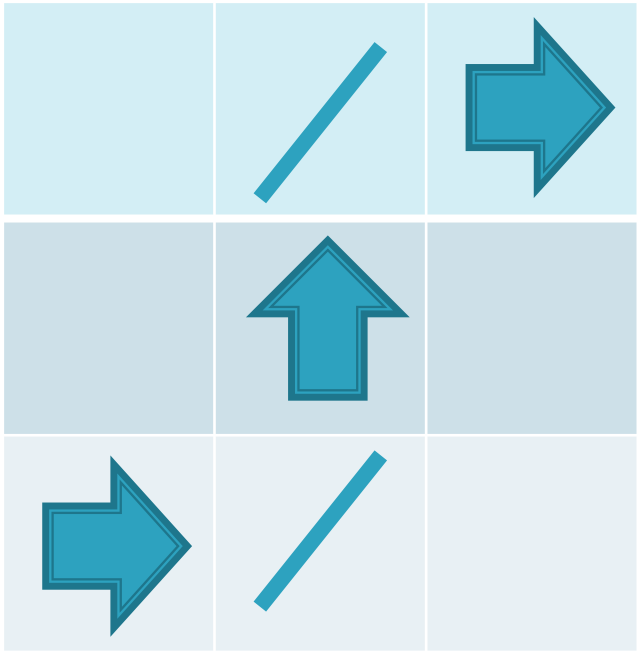
- Do the same for '\'
- Time Complexity: $O(N^2 * 4^N)$

Solution 1

- How to check if a path is valid?

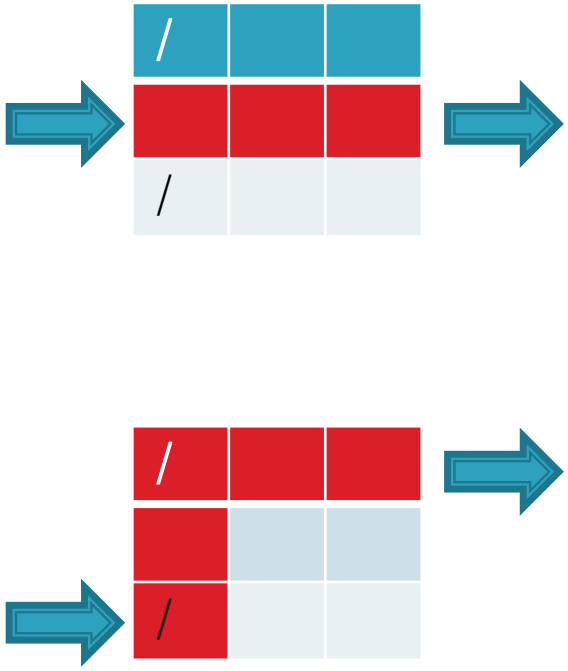
- For ‘/’
- < becomes v, vice versa
- ^ becomes >, vice versa

- For ‘\’
- < becomes ^, vice versa
- v becomes >, vice versa



Solution 1

X	X	X
X		
X		



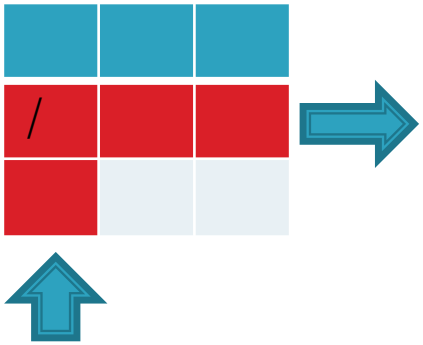
Check every starting point and direction

Solution 1

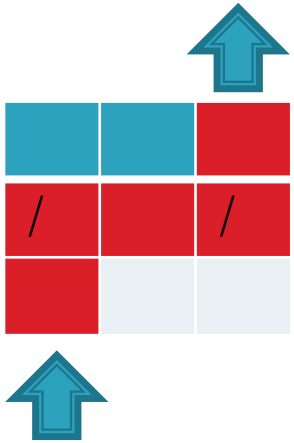
- To check if a path is valid:
- Exhaust every starting point
- Assume (i, j) is the current cell
- Find the next cell (i', j') according to the orientation of the mirror
- If (i', j') is dark, return false
- After reaching the edge, check whether the total number of cells passed = number of bright cells

Solution 1

		X
X	X	X
X		



Invalid

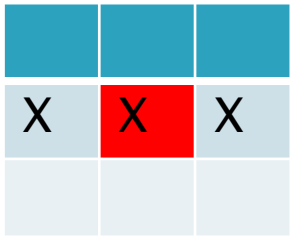


Valid

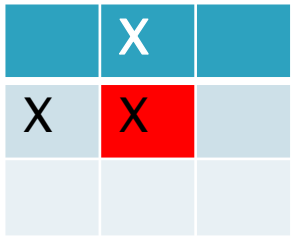
Solution 2

- Observe that all mirrors are on the path
- Instead of assuming mirrors, we can determine the mirrors by considering the path

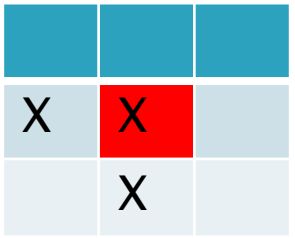
- Assume mirrors are '/'
- If current direction is '>'



No mirror



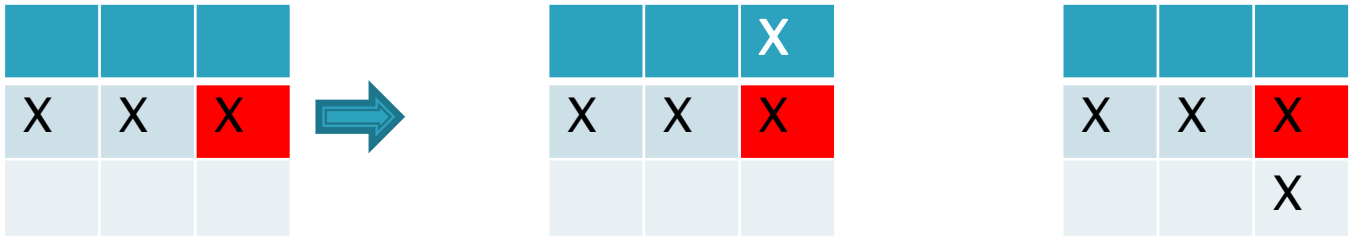
Put mirror



Invalid

Solution 2

- Carefully check cases:
- Direction: ‘>’
- Mirror: ‘/’



End Put mirror Invalid

Solution 2

- Assume all mirrors are '/'
- Exhaust every starting point and direction
  - When walking from a starting point
  - If invalid, exit
  - Compute possible mirrors and update the minimum
- Do the same for '\'
- Time complexity: $O(N^4)$?
- If the function exits immediately when having an invalid case, $O(N^2)$