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8 puzzle problem : The problem is not solvable if the number of inverted pairs are odd. We first check if the puzzle is solvable .

A star search:
Heuristic : No of flipped tile :

```
count of flipped tiles  13 states
Average with flipped  10.833333333333334
```

Heuristic : Manhattan distance: The **Manhattan Distance** is the distance between two points measured along axes at right angles. It performs the best among all the heuristics

```
Manhattan distance  15 states
average manhattan 9.375
paruls-MacBook-Air:Desktop parul$
```

Heuristic: Linear conflict: Two tiles tj and tk are in a linear conflict if tj and tk are in the same line, the goal positions of tj and tk are both in that line, tj is to the right of tk and goal position of tj is to the left of the goal position of tk.

The linear conflict adds at least two moves to the Manhattan Distance of the two conflicting tiles, by forcing them to surround one another. Therefore the heuristic function will add a cost of 2 moves for each pair of conflicting tiles. The Linear Conflict Heuristic is admissible

```
linear conflict exploring 16 states
Average linear conflict 16.0
```

Nim game solver: If the game is played optimally then the first player to go will lose definitely.
We first generate the minimax search tree for each node and then pass that to alpha beta pruning method which then return the move allowed for max and min. The last player to pick up the tile loses.