TCG HW1 Report

Heuristic for Threes! :

The method is based on *Composition of Basic Heuristics for the Game 2048*, with some modifications to fit Threes!.

The heuristic first selects the steps that has the most empty tiles. If two moves have the same value, we then compare the one with higher monotonicity.

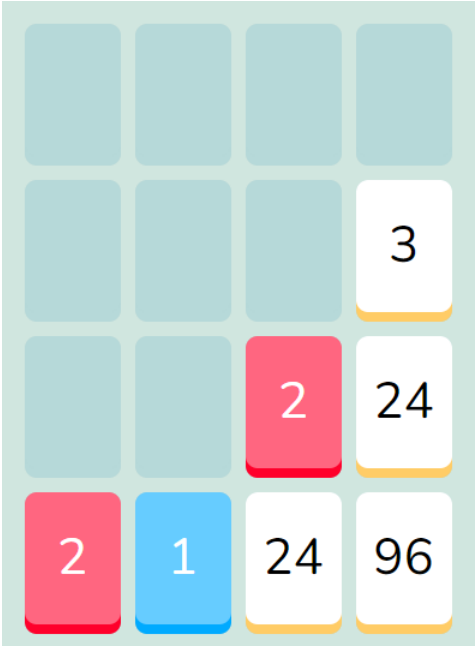
Below is the heuristic for measuring monotonicity in 2048:

Algorithm 2 Scoring a game's monotonicity

Input: G - a game
Output: The game's monotonicity score

```
1:  procedure ScoreMonotonicity(G)
2:      best ← −1
3:      for i ← 1, 4 do
4:          current ← 0
5:          for row ← 0, 3 do
6:              for col ← 0, 2 do
7:                  if G[row][col] ≥ G[row][col + 1] then
8:                      current ← current + 1
9:                  end if
10:             end for
11:         end for
12:         for col ← 0, 3 do
13:             for row ← 0, 2 do
14:                 if G[row][col] ≥ G[row + 1][col] then
15:                     current ← current + 1
16:                 end if
17:             end for
18:         end for
19:         if current > best then
20:             best ← current
21:         end if
22:         Rotate the board 90 degrees clockwise
23:     end for
24:     return best
25: end procedure
```

By measuring using monotonicity, we can build up a board having the highest score, by arranging the tiles, so that they are all non-increasing or all non-decreasing along all rows and columns, and have the highest value being in one of the corners.



However, in Threes!, which is different from 2048, 3s are merged by 1s and 2s.

We view 1s and 2s as the same value, so the above figure shows an example with the highest monotonicity that can be made with the given tiles.