

# CHAIN REACTION GAME

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## Introduction

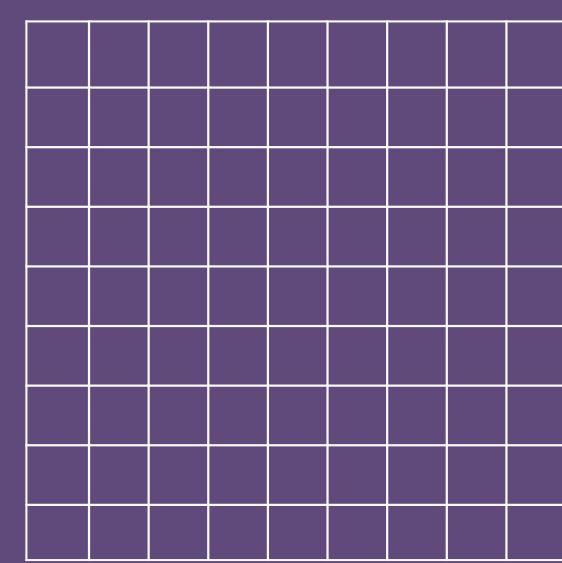
A strategy game for people who like to try out new games. The objective of Chain Reaction is to take control of the board by eliminating your opponents' orbs. Players take it in turns to place their orbs in a cell. Once a cell has reached critical mass the orbs explode into the surrounding cells adding an extra orb and claiming the cell for the player. A player may only place their orbs in a blank cell or a cell that contains orbs of their own color. As soon as a player loses all their orbs they are out of the game. We intend to build an Android app in JAVA to play this game either with your friends or an AI.

The AI bot for Chain Reaction game is made using minimax algorithm with alpha-beta pruning and killer move heuristic.

## Methodology

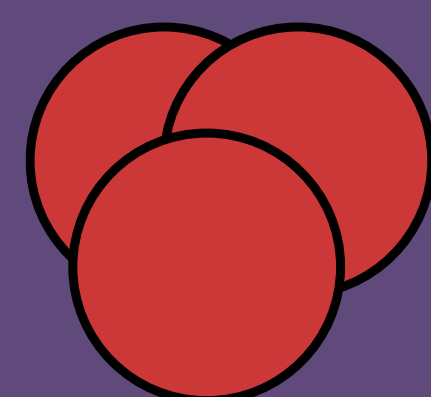
### RULE NO. 1

The gameplay takes place in an  $m$  times  $n$  ( $m \times n$ ) board.



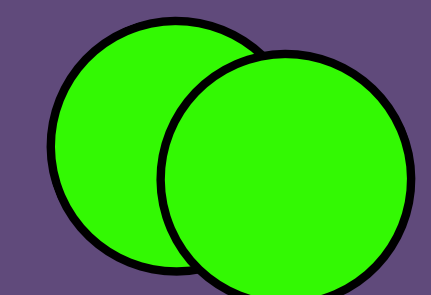
### RULE NO. 2

For each cell in the board, we define a critical mass. The critical mass is equal to the number of orthogonally adjacent cells. That would be 4 for usual cells, 3 for cells in the edge and 2 for cells in the corner.



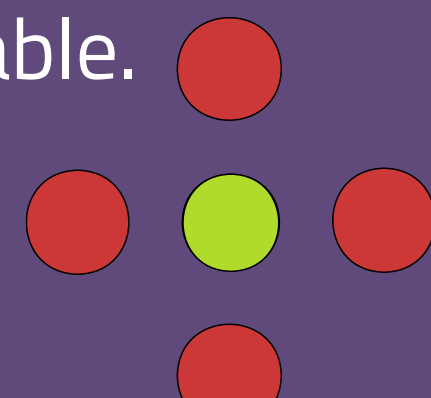
### RULE NO. 3

All cells are initially empty. The Red and the Green player take turns to place "orbs" of their corresponding colors. The Red player can only place a (red) orb in an empty cell or a cell which already contains one or more red orbs. When two or more orbs are placed in the same cell, they stack up.



### RULE NO. 4

When a cell is loaded with a number of orbs equal to its critical mass, the stack immediately explodes. As a result of the explosion, to each of the orthogonally adjacent cells, an orb is added and the initial cell loses as many orbs as its critical mass. The explosions might result in overloading of an adjacent cell and the chain reaction of explosion continues until every cell is stable.



### RULE NO. 5

When a red cell explodes and there are green cells around, the green cells are converted to red and the other rules of explosions still follow. The same rule is applicable for other colors.

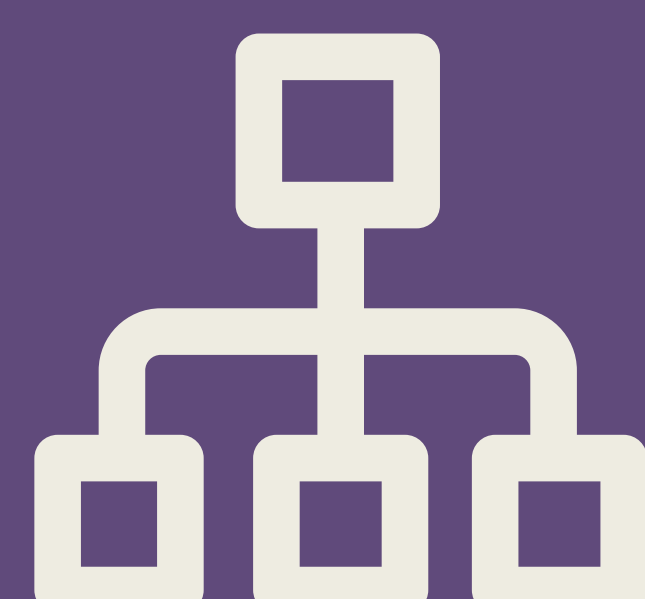


### RULE NO. 6

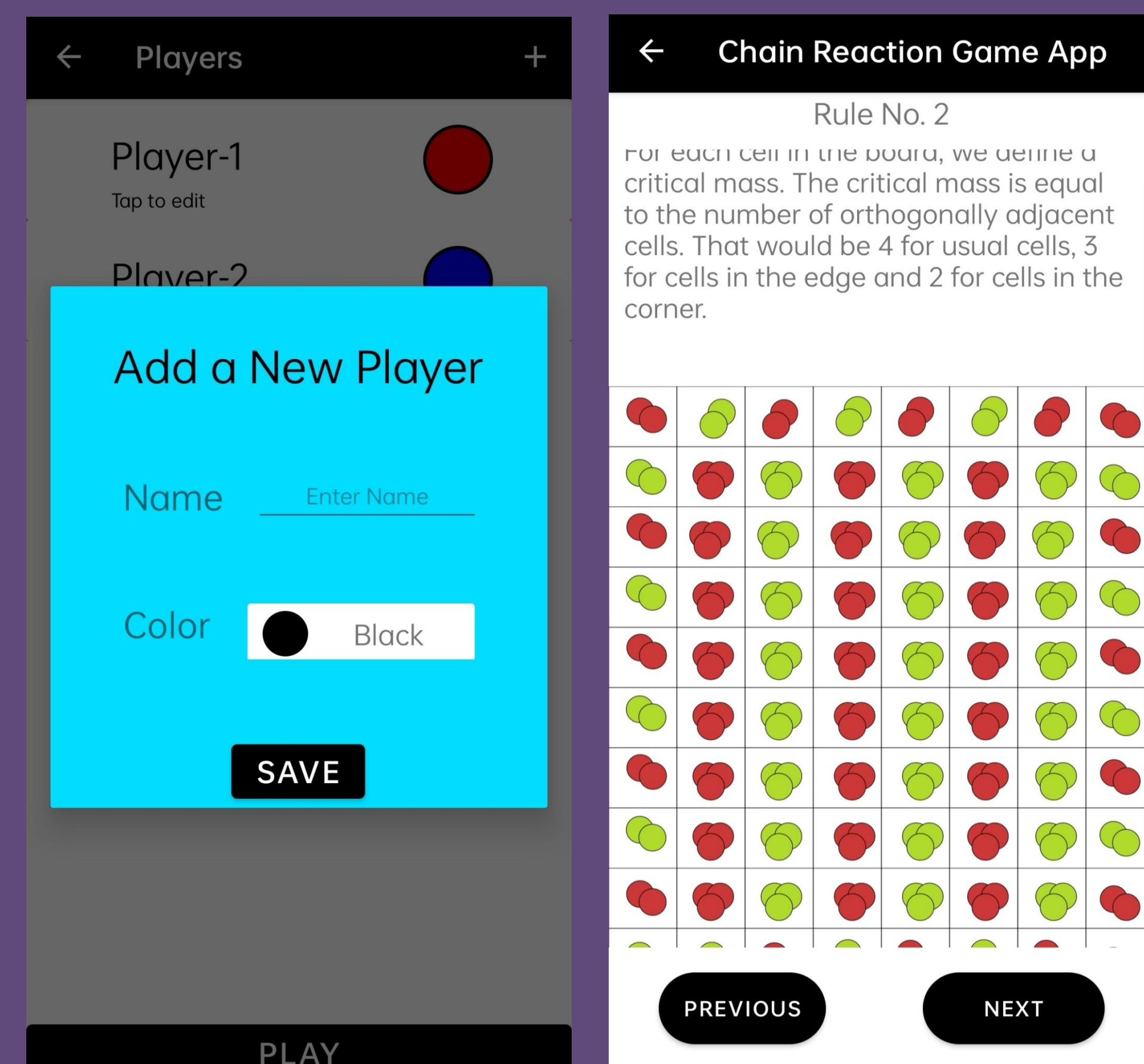
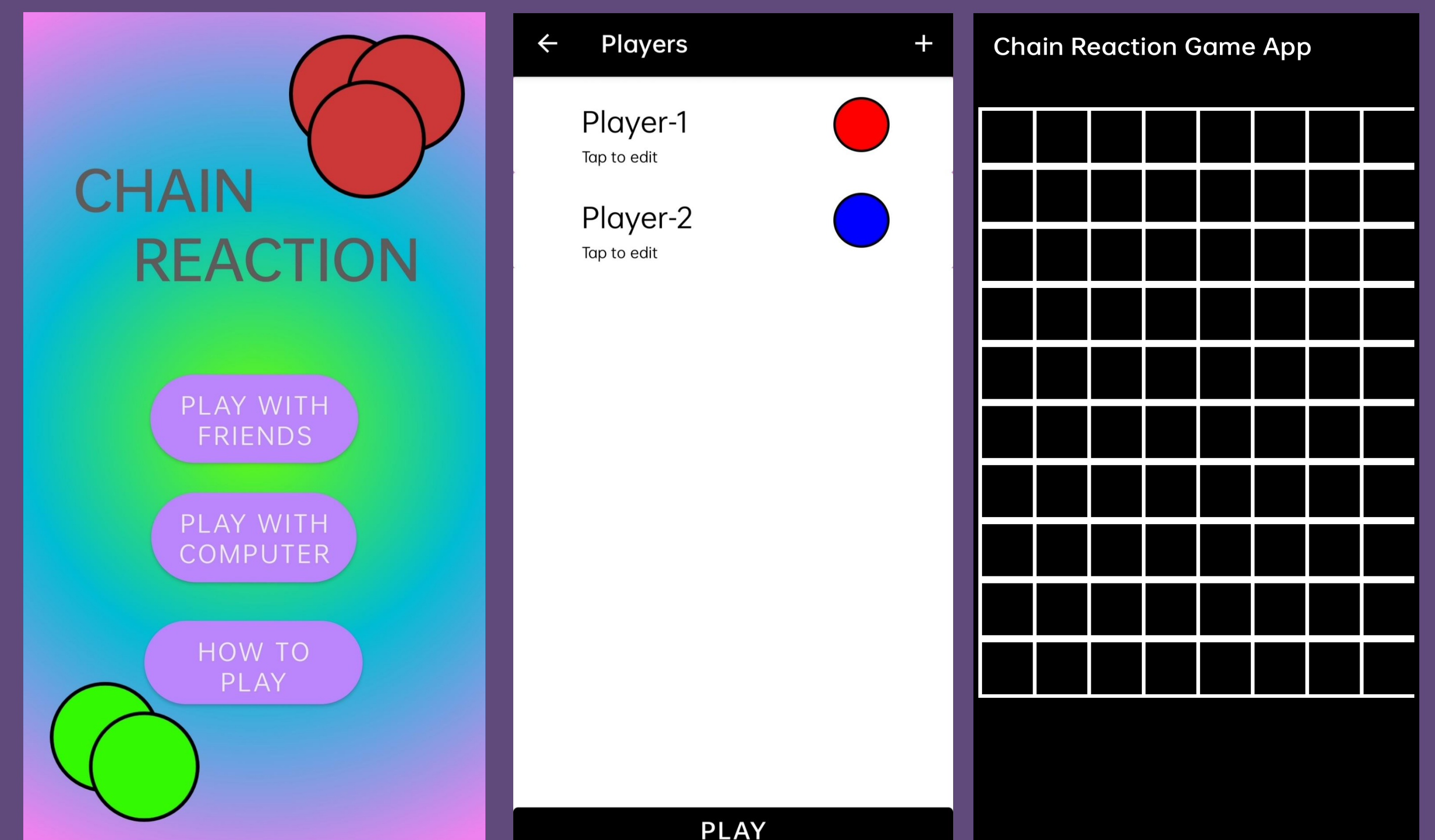
The winner is the one who eliminates every other player's orbs.

## Algorithm Used

- Recursion
- Backtracking
- Mini-max algorithm
- Alpha-beta pruning



## Results



## Conclusion

We have successfully built an Android App in JAVA with the .apk in the appendix section of this report. We were successfully able to implement the AI Version of the game as well as the ability to play with other friends. We have made an interactive and an easy to use and understand UI along with the rules to play the game.

```
for(int i=0;i<game_max_values.length;i++) {
    for (int j=0;j<game_max_values[0].length;j++) {
        if (i==0 && j==0 || i==game_max_values.length-1 && j==game_max_values[0].length-1 || i==0 &&
j==game_max_values[0].length-1 || j==0 && i==game_max_values.length-1) {
            game_max_values[i][j] = 1;
        }else if (i==0 || j==0 || j==game_max_values[0].length-1 || i==game_max_values.length-1){
            game_max_values[i][j] = 2;
        }else {
            game_max_values[i][j] = 3;
        }
    }
}
```

## Acknowledgements

With a deep sense of gratitude, we express our dearest indebtedness to Prof. Pankaj Tyagi, for their support throughout the duration of our project. We would like to thank them for giving us the opportunity to do this wonderful project. Their learned advice and constant encouragement have helped us complete this project. It is a privilege for us to be their students. We are also thankful to our friends and family who have supported us throughout this journey.