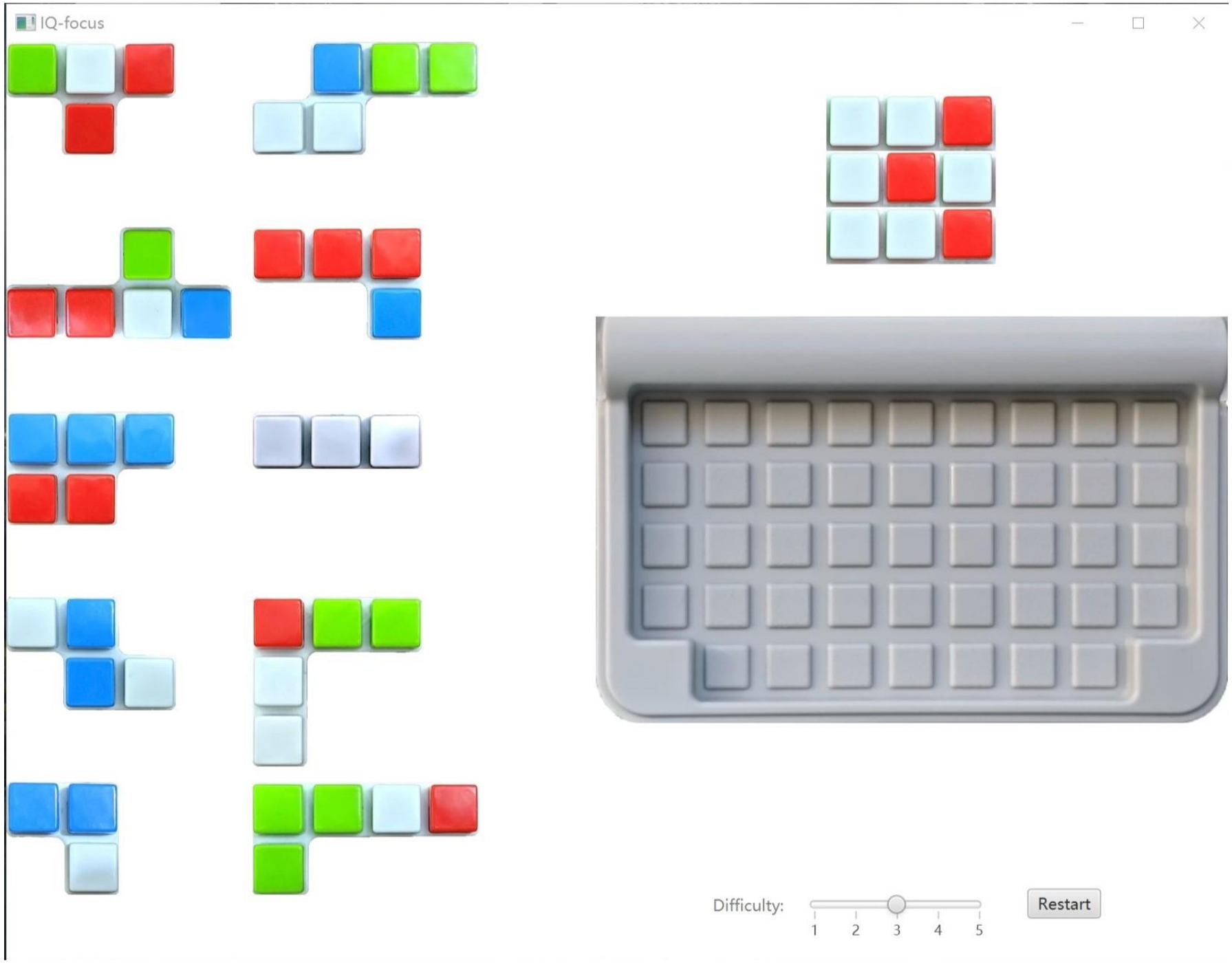
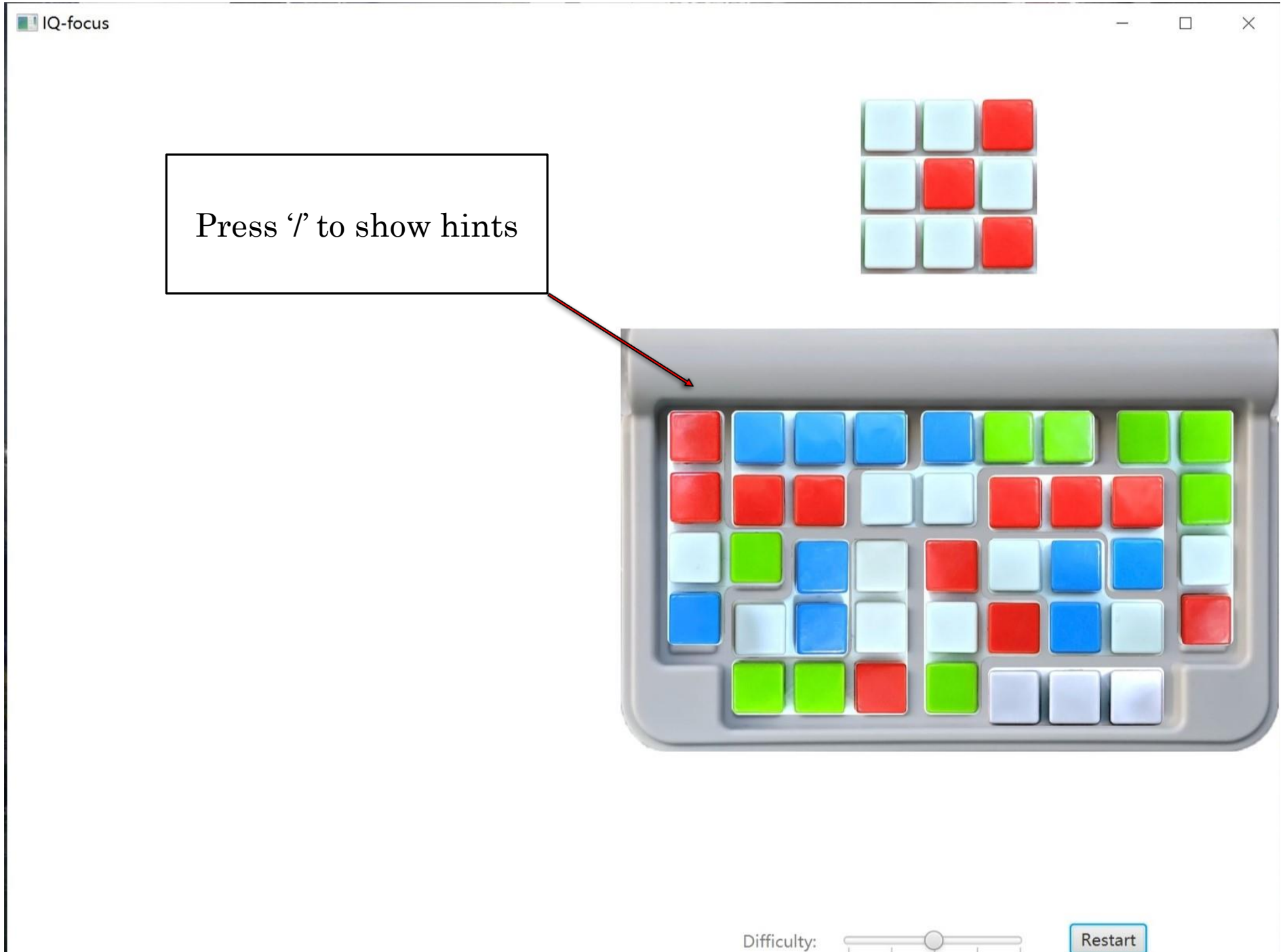
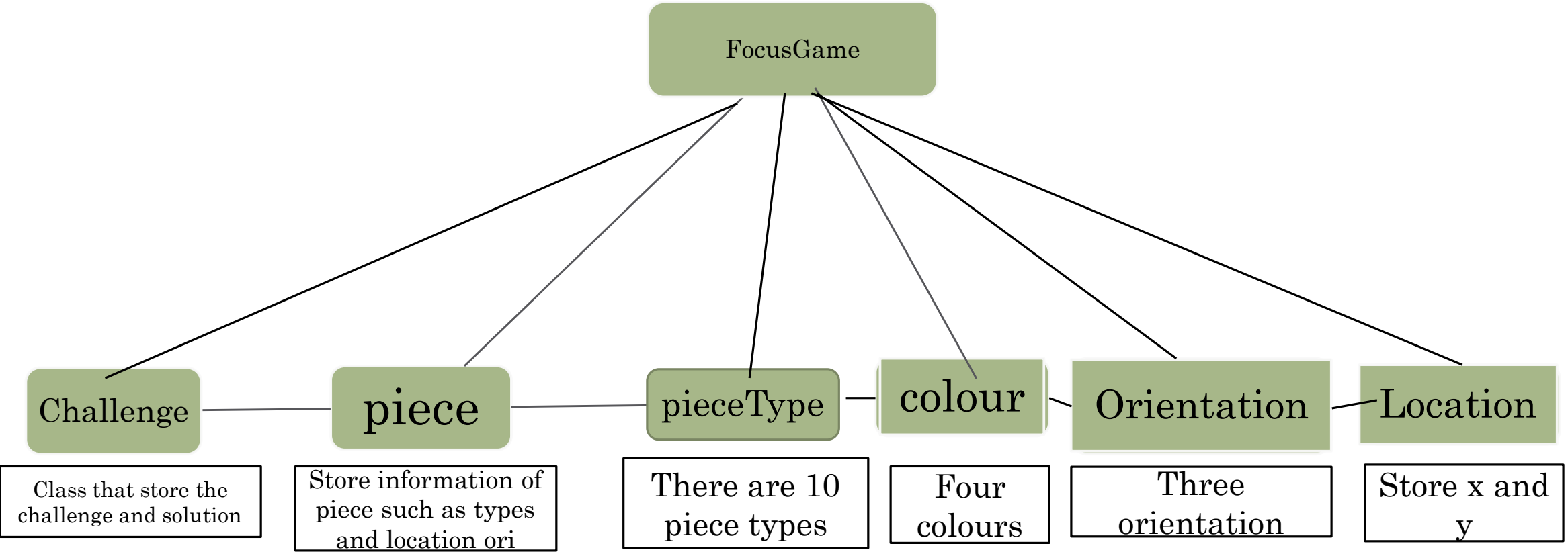
IQ – focus Game

Developed by Yixi Rao, Wenxuan Li and Fang Peng


IQ-focus
Difficulty:
1
2
3
4
5
Restart


IQ-focus
Press '/' to show hints
Difficulty:
Restart

Class structure

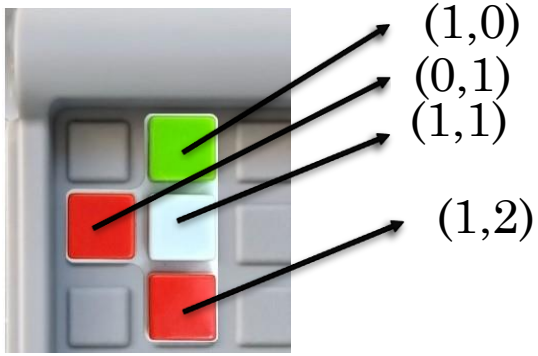


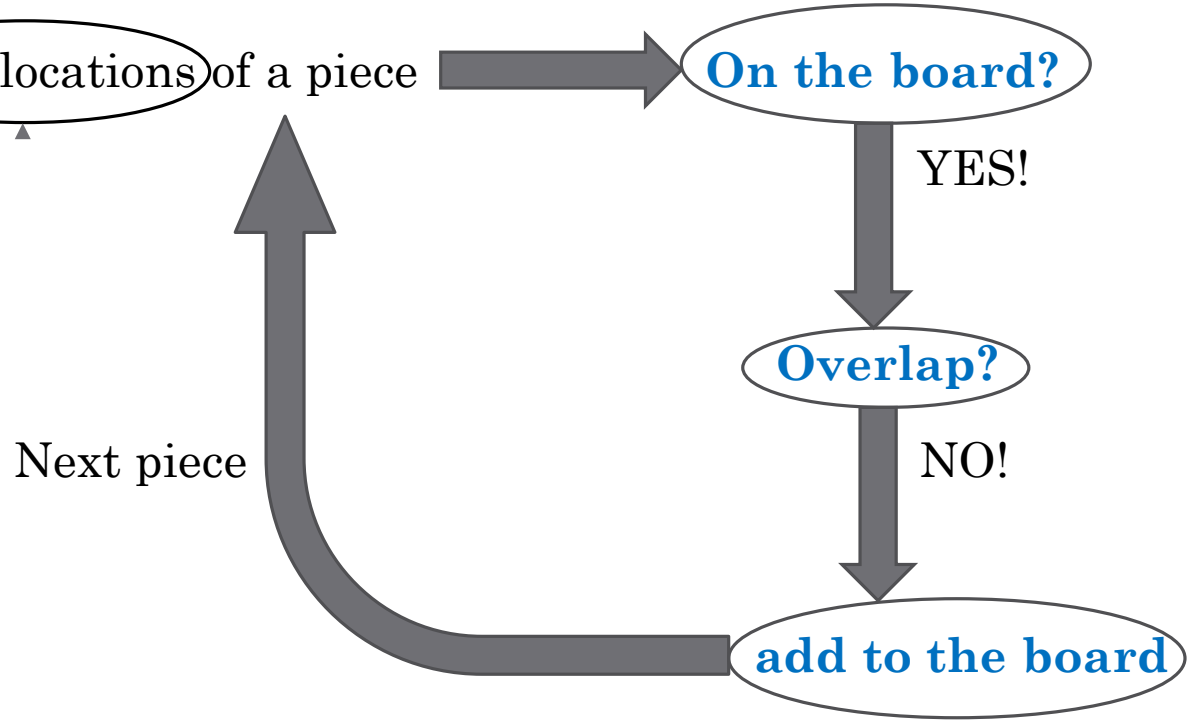
What we did

- Implement a playable board game which is IQ-Focus game and player can choose a different level of challenges and the solution corresponding to it is also given, which can be seen after the player press the ‘/’

Design approach

- **Task 5 algorithm** (we first design the algorithm then try to code it)
- Find all the locations of a piece





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Task 6 optimisation and approach

- **Basis idea** : for every point on the board and every type and every orientation to determine whether it is viable pieces.

For all Y(from 0 to 5)

For all X(from 0 to 8)

For all types(from a to i

For all orientation

```
for (int y:Yrange){                    //for all the x on the board try to find a piece
    for (int x:Xrange){                //for all the y on the board try to find a piece
        for (String type: types){      //for all the types on the board try to find a piece
            for (String orientation:orientations){
                if (isPlacementStringValid(placement + type + "" + x + "" + y + "" + orientation) && isOccupyGrid
                    result.add(type + "" + x + "" + y + "" + orientation);
```

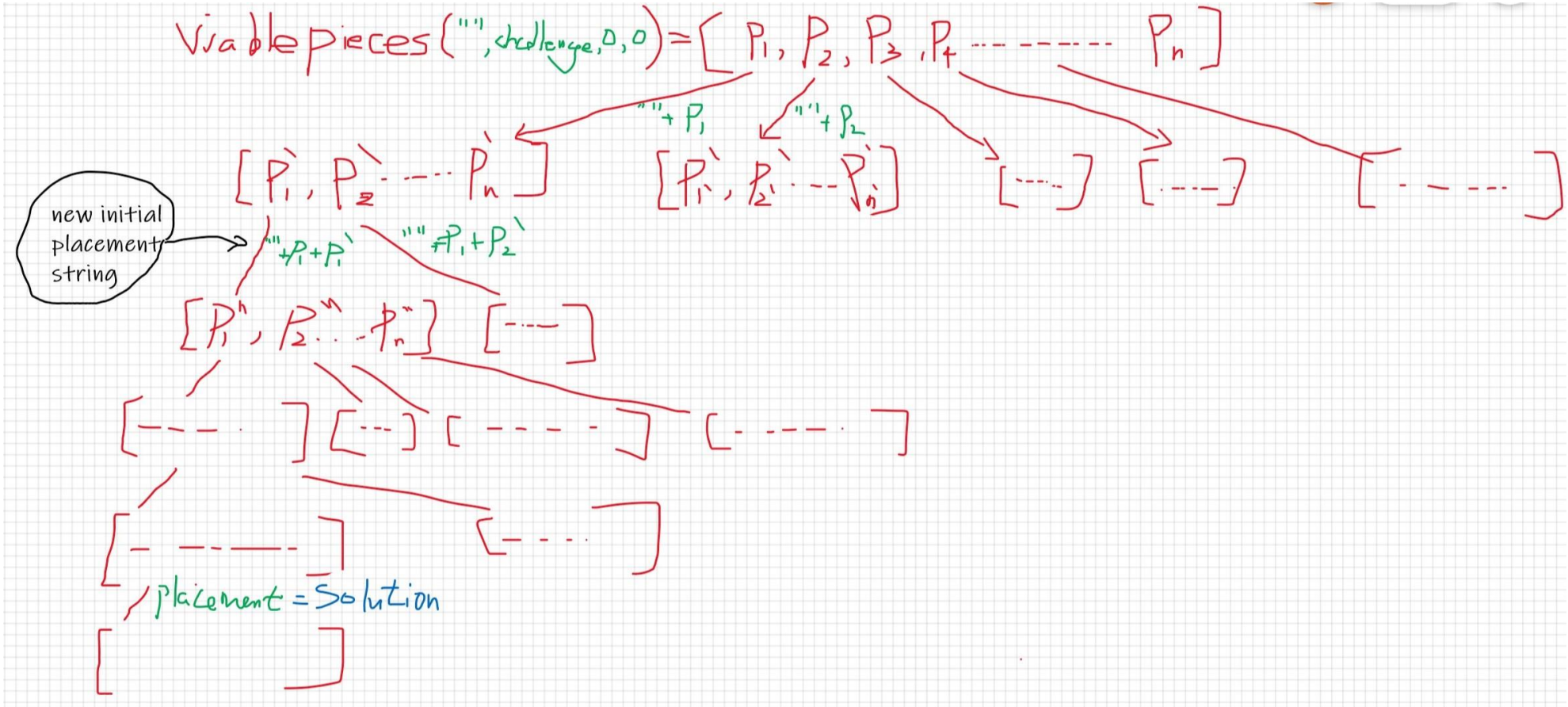
We optimize this program in two aspects.

- **1. curtail locations**: No piece length is longer than 4 so if the distance between the location we want to cover and the location in the loop is longer than 4, it will be skipped.
- **2. Types extraction** : If the types have already appeared in the initially given placement string, then it will be eliminated

```
for (int y:Yrange){                    //for all the x on the board try to find a piece
    if (Math.abs(y - row) > 3)
        continue;
    for (int x:Xrange){                //for all the y on the board try to find a piece
        if (x == 0 && y== 4)
            continue;
        if (Math.abs(x - col) > 3)
            continue;
        for (String type:refineTypes(placement)){   //for all the types on the board try to find a piece
            for (String orientation:orientations){
                if (isPlacementStringValid(placement + type + "" + x + "" + y + "" + orientation) && isOccupyGrid(col,row,new
```

Task 9 optimisation and approach

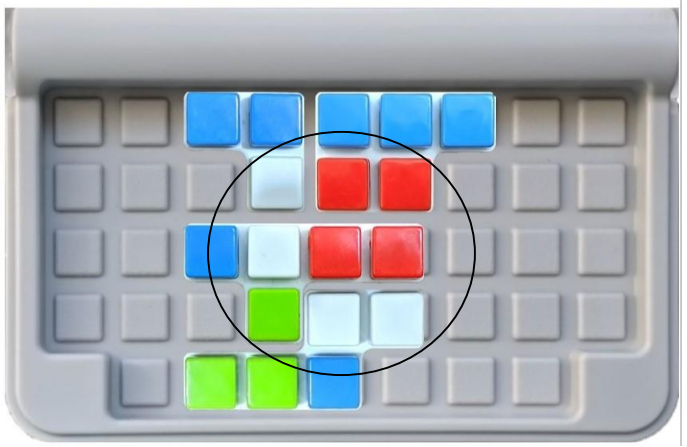
- **Early idea**: Start from the first point (0,0), and call the function of task 6 to find viable pieces and then Recursively loop through each piece and reuse the task 6 function until finding the correct one.



- **Result**: too slow!

Optimized program of task 9

- Still, go through each location but this time we first find a set of placement string that occupies the central nine locations and satisfies the challenge. Pass each placement string as an initial placement
- E.g. central placement string



- Then Based on this set, do the recursion

- **How did we come up with that**: There's a big difference in speed when we use just one piece or more pieces as an initial placement compared without any pieces as initial placement string.
- **Reason:** And it will reduce the time of searching because it prunes off useless branches of all possible placement strings.

Other small optimisation

- **1**. if it is already placed on the board, skip it and Jump to the next point until the current location is not occupied.

```
while (pieces[y][x] != null){   //if the loication is already occupied by some pieces than it will be skipped
    Location nextP1 = nextPoint(x,y);
    x = nextP1.getX();y = nextP1.getY();
}
```

  - It will optimize the program since it can never go through some points which are already occupied

- **2.** Once find the dead cell (dead cell means an empty cell surrounded by occupied cell), jump out of the loop!
- E.g.

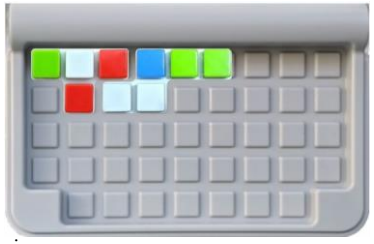
```
if (viablePieces == null){   // it is null means it is a dead cell and this a optimisation
    pieces = new Piece[5][9];
    return "";
}
```

  - viablePieces == null means No viable piece can occupy this location so it is a dead cell.
  - **Explanation**: skipping a dead cell can cut off the useless branches of that loop. So that is the main reason why we use it.

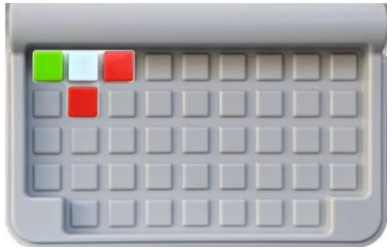
Interesting aspects of our game

- Our JavaFx design is referred to the assignment 1 “Game” class
- **1.**When we design the draggable piece, we set up a rule, which is when we rotate the piece that is on the board, if it is overlapped or out of the board then it will snap to home.

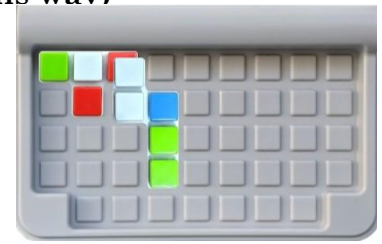
(if we want to rotate the piece b200 to b201)



(it will snap to home since it will violate the game rule)



(this will not happen, but in Of assignment 1, tile can rotate in this way)



```
/**
 * Rotate the piece by 90 degrees and update any relevant sta
 */
private void rotate() {
    orientation = (orientation + 1) % 4; // recursion of or
    setImage(images[(orientation)]);
    rotateSetFit(orientation);
    toFront();
    setPosition();  //modify the location and orientation
    if (!validPiece()){
        snapToHome();
    }
```

Just simply add a function after rotation to judge whether it is valid or not

Interesting aspects of our game

- **2.** Ingenious and interesting way of storing the piece location after snapping the piece to the board

```
/* it will store the message of each piece which is already placed to the board e.g. a001*/
private String[] pieceState = new String[10];
```

- (after we drag a piece into the board the information of piece will be stored in this array)

Notice that if we combine all the element in the array, we will get a placement string then we can do interesting thing

- **3.** Another interesting aspect is that we call the function of task 5 to judge whether a location is occupied or not.

```
private boolean validPiece() {
    String placement = "";
    for (String p:pieceState){  //set up all the placement as a placement string
        placement = placement + p;
    }
    if (placement.equals(""))
        return true;
    return FocusGame.isPlacementStringValid(placement);     //use already placement string and add it to new piece
}
```

(we can use that array to create a placement string and pass it to task 5 function to test whether it is valid or not.)

If valid allow to rotate

Otherwise snap to hone

- Reusing the function can make our program coherent and space-saving.

Thank you!