IQ-Fit Game

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  - Board design
  - Viewer design (mainly JavaFX)
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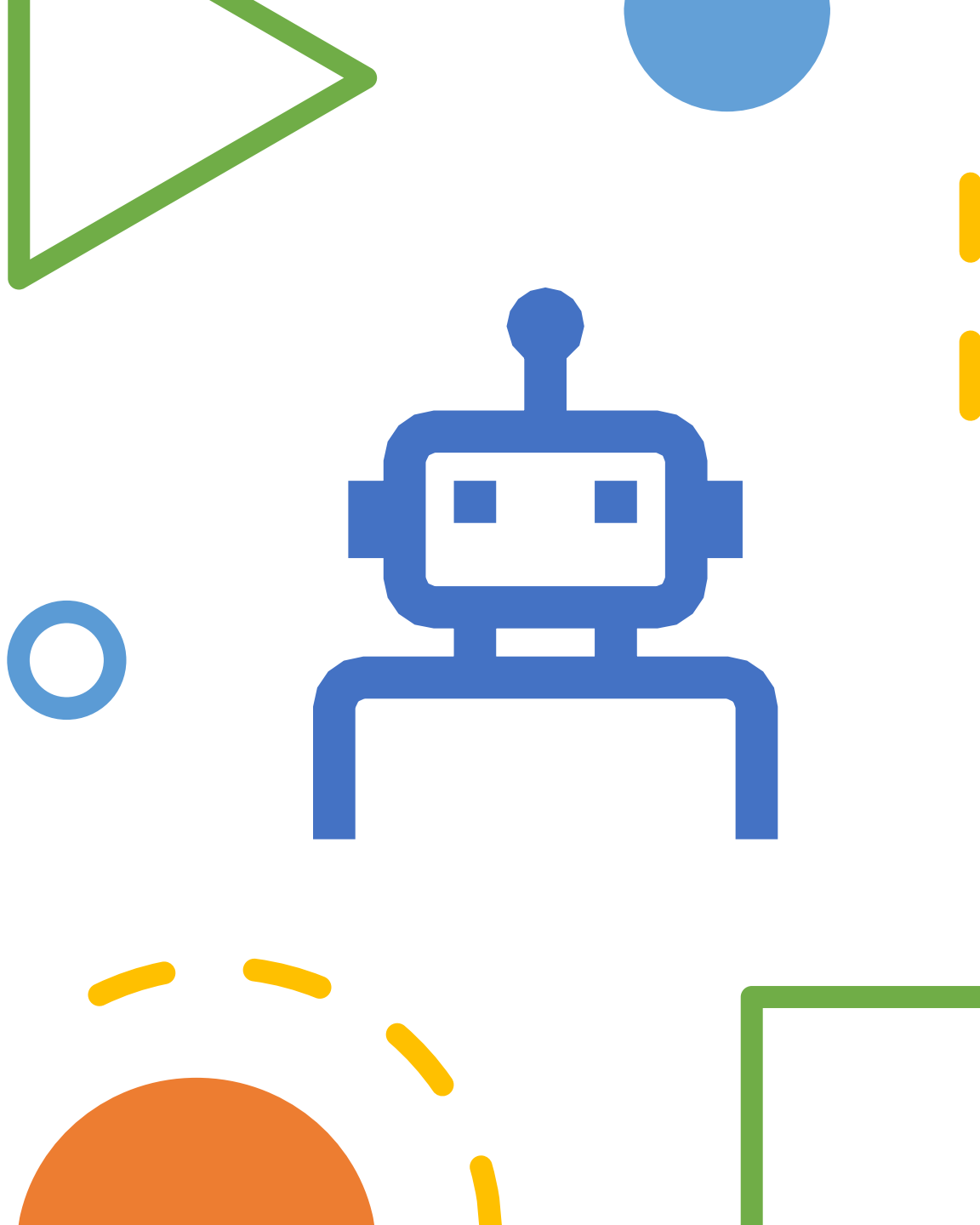
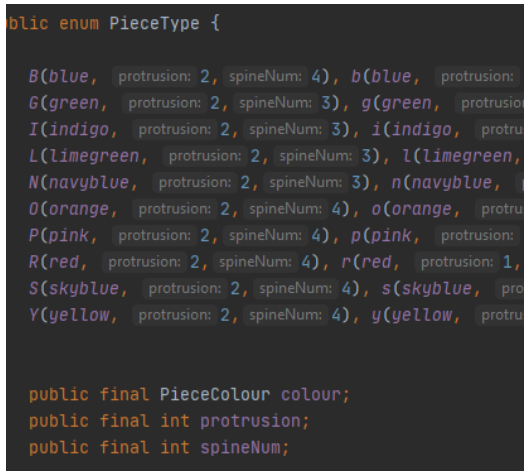
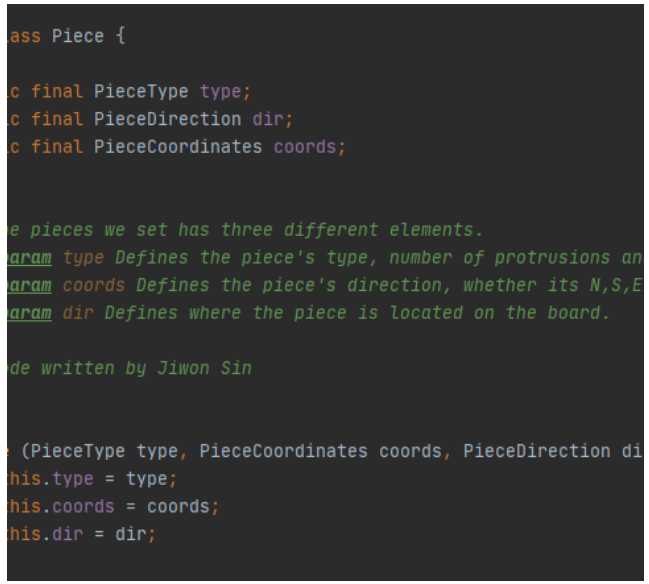
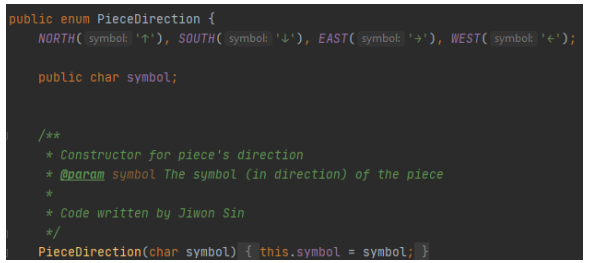
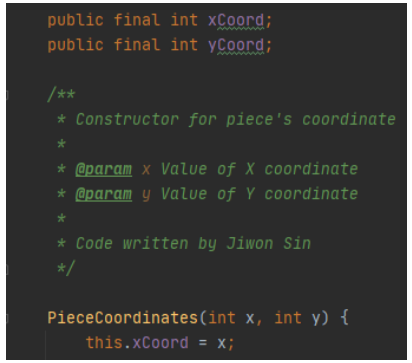


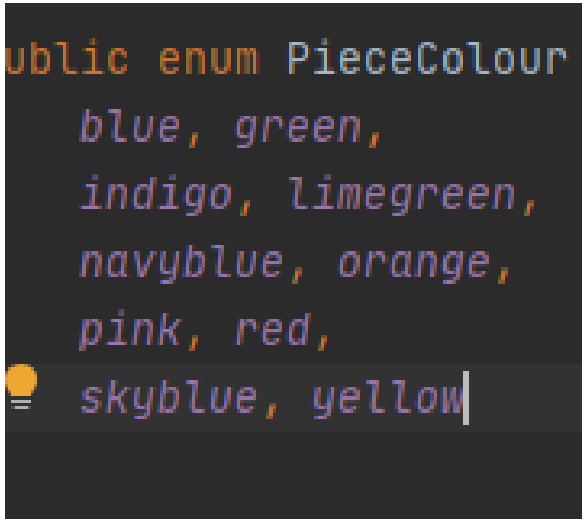






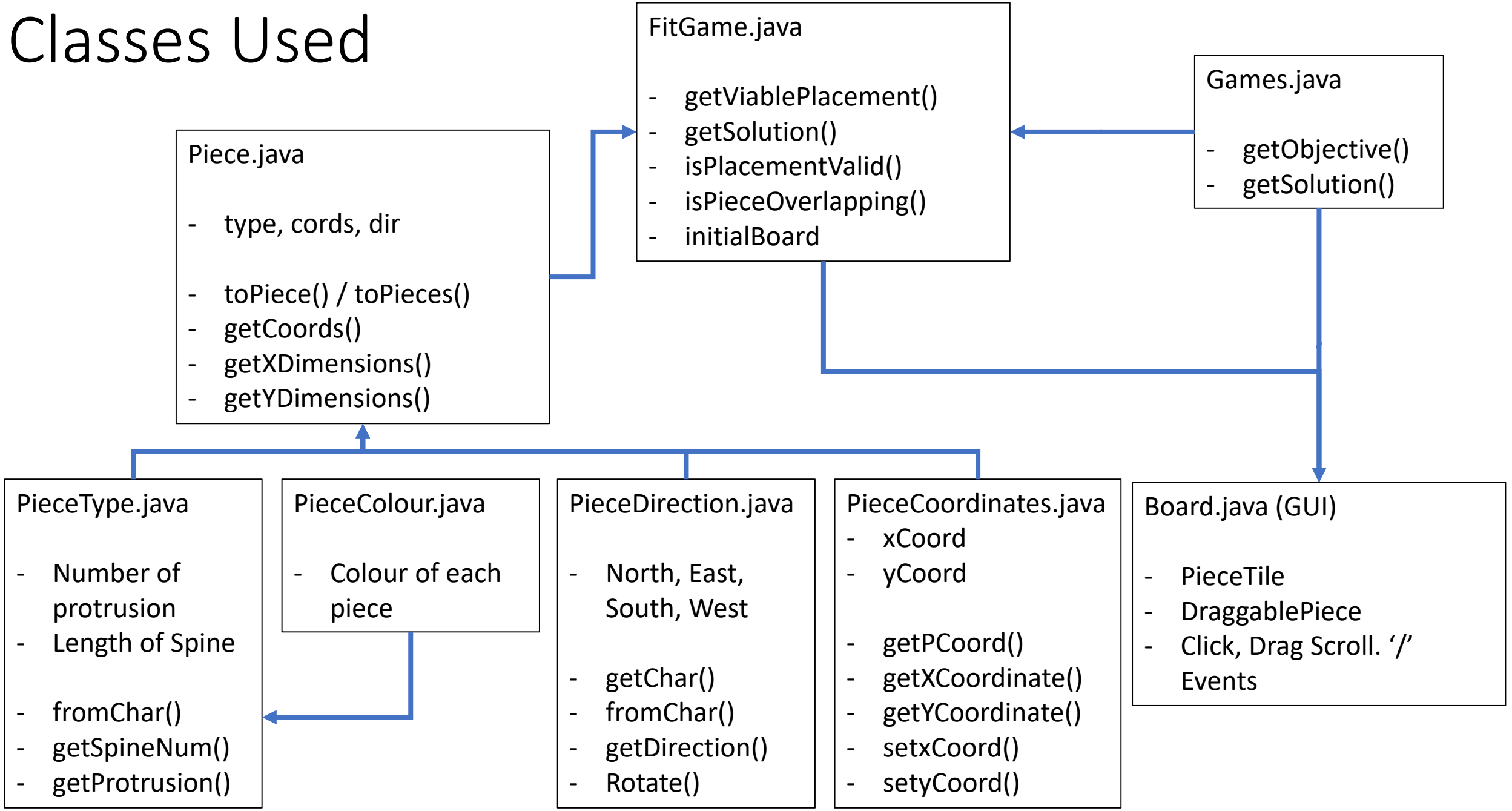
Piece and Board definition





- Piece comprises of
  - Type
    - Colour
    - Protrusion
    - spineNum
  - Coordinates
  - Direction
- Converting String to Piece
- How to apply these Pieces to gameboard?

Classes Used



Key Components : Board and Pieces

How to convert placement to Piece?

Use getCoords()

Checks the colour and direction

How to define game board?

Use 2-Dimensional Array

PieceType [][] initialBoard

How to apply Piece to game board?

```
[b, b, b, b]
[b, null, null, null]
```

```
public PieceType [][] getCoords() {
    PieceType [][] array = new PieceType[getYDimensions()][getXDimensions()];
    switch (type) {
        case b:
            if (dir == NORTH) {
                for (int i = 0; i < getYDimensions(); i++) {
                    for (int j = 0; j < getXDimensions(); j++) {
                        if (i == 0)
                            array[i][j] = b;
                        else if (i == 1 && j == 0)
                            array[i][j] = b;
                        else
                            array[i][j] = null;
                    }
                }
            }
            if (dir == EAST) {
                for (int i = 0; i < getYDimensions(); i++) {
                    for (int j = 0; j < getXDimensions(); j++) {
                        if (j == 1)
                            array[i][j] = b;
                        else if (i == 0 && j == 0)
                            array[i][j] = b;
                        else
                            array[i][j] = null;
                    }
                }
            }
```

Key Components : Board and Pieces

How to convert placement to Piece?

Use getCoords()

Checks the colour and direction

How to define game board?

Use 2-Dimensional Array

PieceType [][] initialBoard

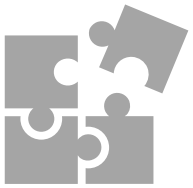
How to apply Piece to game board?

```
Piece[] pieces = toPieces(placement);

PieceType[][] initialBoard = {
        {null, null, null, null, null, null, null, null, null, null},
        {null, null, null, null, null, null, null, null, null, null},
        {null, null, null, null, null, null, null, null, null, null},
        {null, null, null, null, null, null, null, null, null, null},
        {null, null, null, null, null, null, null, null, null, null}
};

for (Piece piece : pieces) {
    PieceType[][] array = piece.getCoords();
    int x = piece.coords.getXCoordinate();
    int y = piece.coords.getYCoordinate();
    for (int j = x; j < x + piece.getXDimensions(); j++) {
        for (int i = y; i < y + piece.getYDimensions(); i++) {
            if (initialBoard[i][j] != null && array[i - y][j - x] != null) {
                return false;
            }
            if (array[i - y][j - x] != null) {
                initialBoard[i][j] = array[i - y][j - x];
            }
        }
    }
}
return true;
```

Key Components : GUI

PieceTile

Checks whether its valid type



DraggablePiece

Obtain pieces via setPlayablePieces()

makePieces() constructs pieces graphically

Different events update pieceID

snapToGrid()

Calculates x and y values based on x and y coordinates on the board

Snapping animation

Range of values

PieceTiles

```
static class PieceTile extends ImageView {
    String pieceID;

    PieceTile(String piece) {
        char [] pieceArray = {'b','g','i','l','n','o','p','r','s','y'};
        char [] pieceArrayUp = {'B','G','I','L','N','O','P','R','S','Y'};
        for (int i = 0; i < pieceArray.length; i++){
            if ((piece.charAt(0) == pieceArray[i] || piece.charAt(0) == pieceArrayUp[i])) {
                break;
            }
            else {
                if (i == 9) {
                    throw new IllegalArgumentException("Bad piece: " + piece + " at " + i);
                }
            }
        }
        this.pieceID = piece;
        setFitWidth(SQUARE_SIZE * fromChar(piece).getSpineNum());
        setPreserveRatio(true);
    }
}
```

```
class DraggablePiece extends PieceTile {
    double homeX, homeY;
    double mouseX, mouseY;
    int orientation; // 0 = NORTH, 1 = EAST 2 = SOUTH 3 = WEST
    int positionX, positionY;
    char type;

    DraggablePiece(String placement) {
        super(placement);
        type = placement.charAt(0);
        orientation = 1;
        char piece = placement.charAt(0);

        Image pieceImage;

        positionX = Character.getNumericValue(placement.charAt(1));
        positionY = Character.getNumericValue(placement.charAt(2));

        if (Character.isLowerCase(type))
            pieceImage = new Image(getClass().getResource( name: URI_BASE + Character.toUpperCase(placement.charAt(0)) +"1.png").toString());
        else
            pieceImage = new Image(getClass().getResource( name: URI_BASE + (placement.charAt(0)) +"2.png").toString());
        setImage(pieceImage);
```

```
// Handling events

    setOnMousePressed(mouseEvent -> {
        mouseX = mouseEvent.getSceneX();
        mouseY = mouseEvent.getSceneY();
        toFront();
        if (FitGame.isPlacementValid(pieceID)) {
            clearInitialBoard(pieceID);
            Board.addedPieces.remove(pieceID);
        }
        mouseEvent.consume();
    });

    setOnMouseDragged(mouseEvent -> {
        double movementX = mouseEvent.getSceneX() - mouseX;
        double movementY = mouseEvent.getSceneY() - mouseY;
        setLayoutX(getLayoutX() + movementX);
        setLayoutY(getLayoutY() + movementY);
        mouseX = mouseEvent.getSceneX();
        mouseY = mouseEvent.getSceneY();
        mouseEvent.consume();
    });

    setOnScroll(scrollEvent -> {
        if (!isPieceOnBoard()) {
            setRotate((orientation) * 90);
            orientation++;
            setFitWidth(getPieceSpineNum(pieceID) * SQUARE_SIZE);
            setPreserveRatio(true);
            if (orientation == 5)
                orientation = 1;
        }
    });
```

```
setOnMouseReleased(mouseEvent -> {
    updatePieceID();
    if (FitGame.isPlacementValid(pieceID)) {
        if (FitGame.isPlacementNotOverlapping(initialBoard, pieceID)) {
            snapToGrid();
            FitGame.boardUpdate(pieceID, initialBoard);
            Board.addedPieces.add(pieceID);
            if (isItComplete()) {
                showCompletionText();
                makeCompletionText();
            }
        }
        else {
            setLayoutX(homeX);
            setLayoutY(homeY);
        }
    }
    else {
        setLayoutX(homeX);
        setLayoutY(homeY);
    }
    mouseEvent.consume();
});
```

Events

Problem and Challenges

- Connecting FitGame.java with GUI
  - Methods in FitGame.java
  - GUI in Board.java
- Increasing efficiency
  - getViablePiecePlacements()
  - getSolution()

GUI and backend programming

Check whether the piece placement is valid

Not overlapping board

- isPlacementNotOverlapping()

Updating board

- boardUpdate()

Check validity of certain placement

- isPlacementValid()

Use PieceType [][] initialBoard

Increase efficiency

getViablePiecePlacements()

- Diversify conditions
- Multiple methods

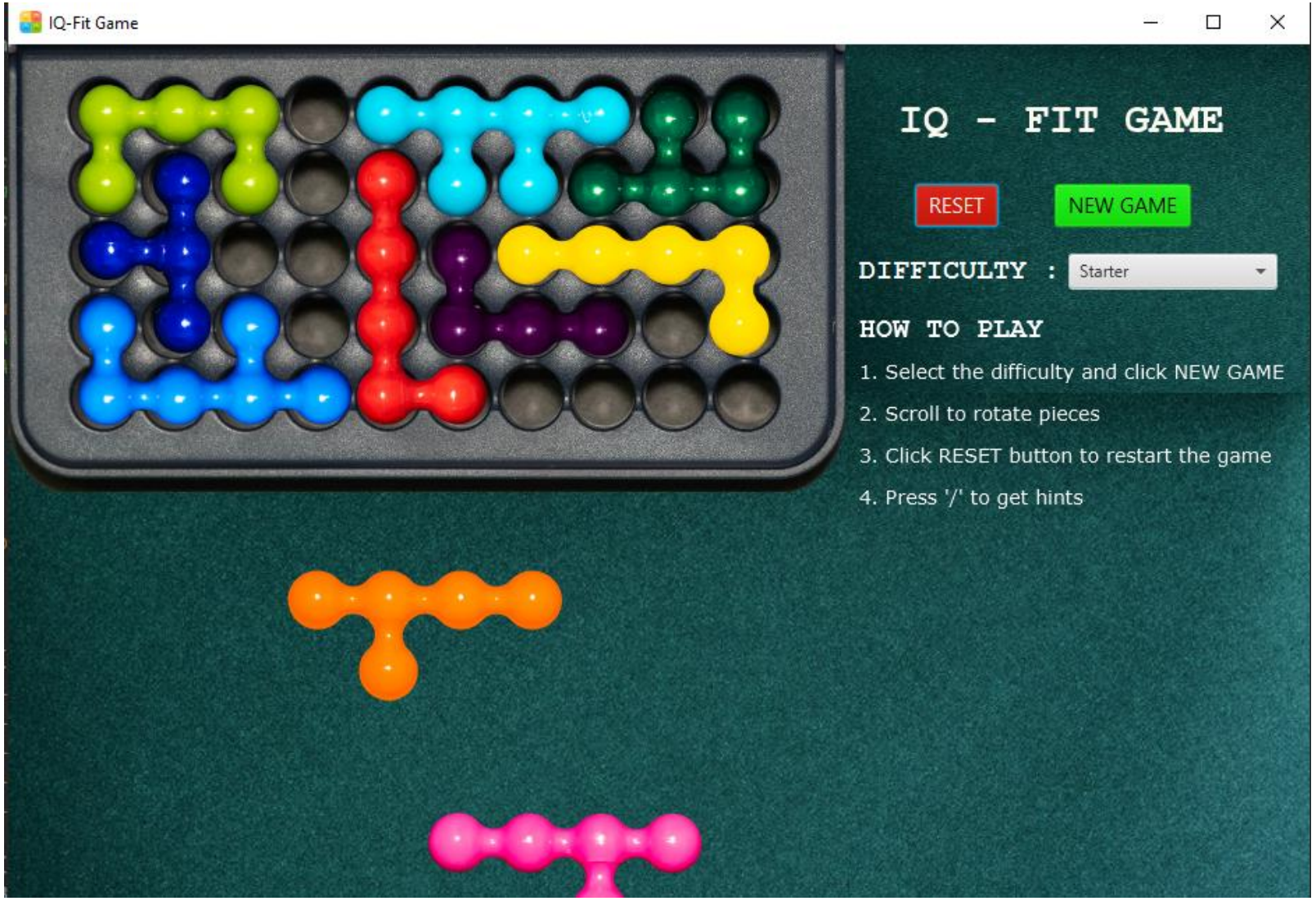
```
public static boolean isThisLogical(String challenge, PieceType [][] initialBoard) {
    for (int i = 0; i < 5; i++) {
        for (int j = 0; j < 10; j++) {
            if (initialBoard[i][j] == null) {
                if (getViablePiecePlacements(challenge,j,i) == null)
                    return false;
            }
        }
    }
    return true;
}
```

getSolution()

- Check whether its “logical”
- Is it possible to have *null* surrounded by PieceTypes?
  - isThisLogical()
- Check which one has least possible choices
  - findOptimalX()

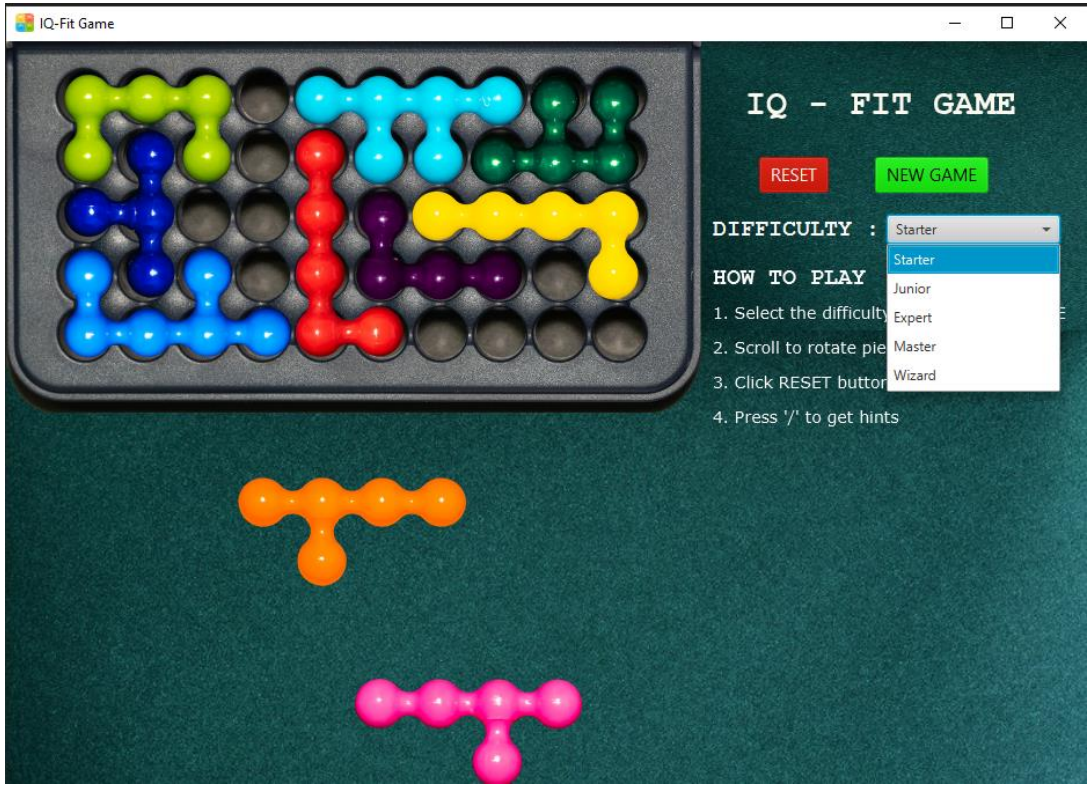
```
public static List<Integer> findOptimalX(String challenge, PieceType [][] board) {
    int possiblePieces = 100;
    int chances;
    List<Integer> array = new ArrayList<>();
    Set<String> numPieces;
    for (int i =0; i < 5; i++) {
        for (int j = 0; j < 10; j++) {
            if (board[i][j] == null) {
                numPieces = getViablePiecePlacements(challenge, j, i);
                if (numPieces != null) {
                    chances = numPieces.size();
                    if (numPieces.size() < possiblePieces) {
                        possiblePieces = chances;
                        array.clear();
                        array.add(i);
                        array.add(j);
                    }
                }
            }
        }
    }
    return array;
}
```

Game Demonstration



Start of the IQ-Fit Game

Select Difficulty



- 5 Different Difficulty Levels

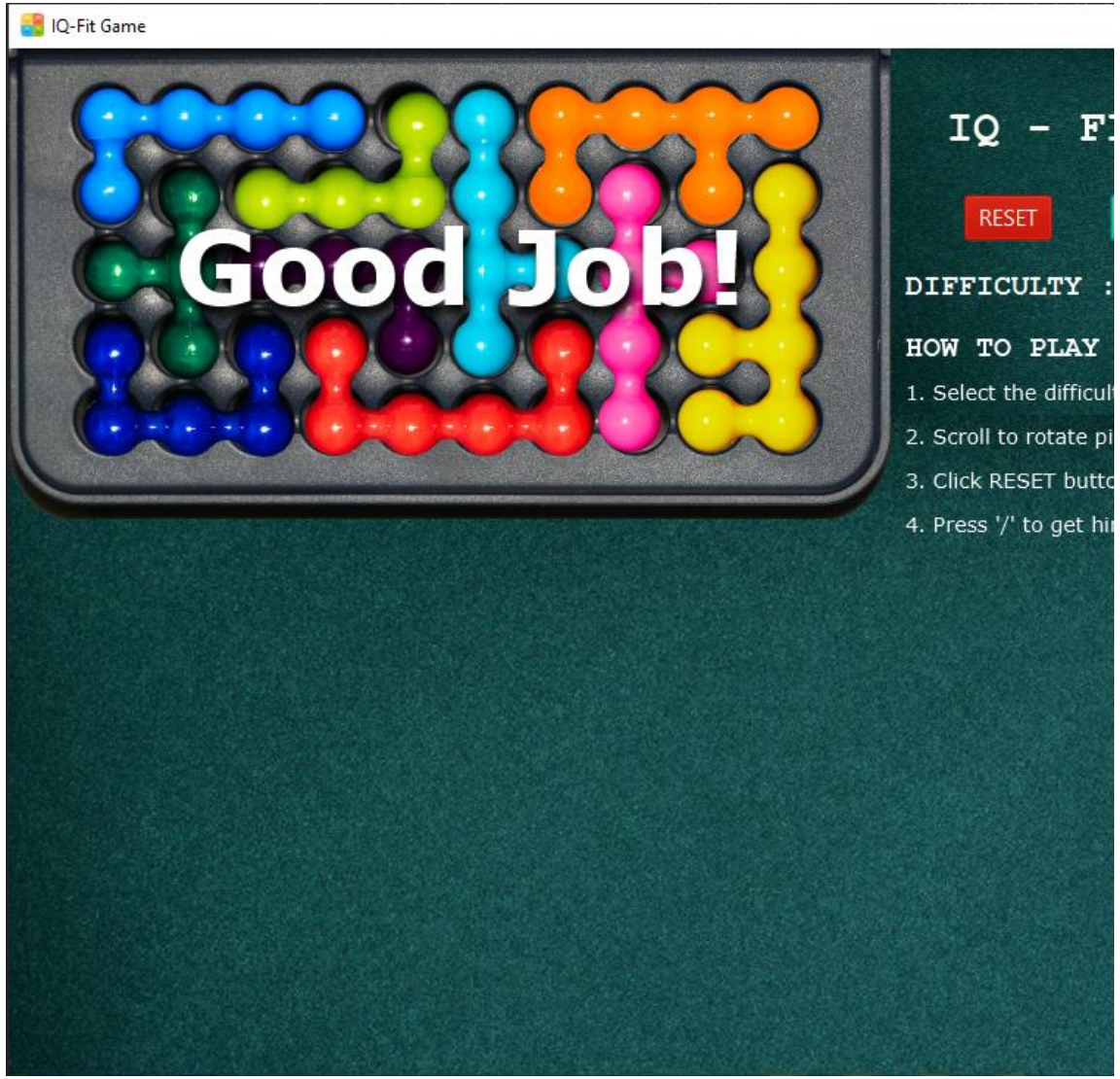
  - Starter
  - Junior
  - Expert
  - Master
  - Wizard
  - The game starts with “Starter” difficulty as a default

Buttons

- NEW Game
  - Choose a new game but with same difficulty level
  - Game selected in random (0 – 24 random number)
- RESET
  - Resets the pieces
  - When users want to reset the stage
- Rotating pieces
  - By scrolling mouse wheel, the piece rotates
- Getting hints
  - Press ‘/’ button each time

End of Game

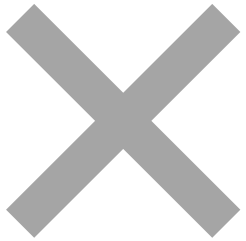
- At the end of game
  - Pieces placed does not move when the game endsPlayer can choose to play another game.



Reflections

Regrettably, getSolution() takes too much time

If difficulty level is at Wizard, test could time out.



Hint function fails to work

No hints are displayed if the player places a piece on incorrect slot.


Q & A