Course: Principals of Software Development – ENSF 409
Lab 6
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Exercise B

BlockingPlayer.java

```
import java.io.BufferedReader;
import java.io.PrintWriter;

/**
 * Provides a tic tac toe robot Player that attempts to block every move it's opponent makes.
 * @version 1.0
 * @author Mitchell Sawatzky and Connor Newman
 * @since Mar 2016
 */
public class BlockingPlayer extends RandomPlayer {

    /**
     * Constructs a BlockingPlayer object with the specified name, mark, and board.
     * @param name the Player's name
     * @param mark the Player's mark
     * @param board the Player's board
     * @param in the incoming socket
     * @param out the outgoing socket
     */
    public BlockingPlayer(String name, char mark, Board board, BufferedReader in, PrintWriter out) {
        super (name, mark, board, in, out);
    }

    /**
     * Detects whether or not the opponent is about to win, and blocks it if necesarry, otherwise it makes
a random move.
     */
    protected void makeMove() {
        for (int i = 0; i < 3; i++) {
            for (int j = 0; j < 3; j++) {
                if ((board.getMark(i, j) == SPACE_CHAR) && testForBlocking(i, j)) {
                    board.addMark(i, j, mark);
                    return;
                }
            }
        }
        super.makeMove();
    }
    /**
     * Tests wether or not the specified board space would win the game for the opponent if they played
there on the next turn.
     * @param row the row of the board to test
     * @param col the column of the board to test
     * @return true if the space needs to be blocked, false otherwise
     */
    protected boolean testForBlocking(int row, int col) {
        char oM = opponent.mark();
        boolean res = true;

        // row
        for (int i = 0; i < 3; i++) {
            if ((i != col) && (board.getMark(row, i) != oM)) {
                res = false;
                break;
            }
        }
        if (res)
            return true;

        // col
        res = true;
        for (int i = 0; i < 3; i++) {
            if ((i != row) && (board.getMark(i, col) != oM)) {
                res = false;
                break;
            }
        }
        if (res)
            return true;

        // can't be diagonal
        if ((row + col) % 2 != 0)
            return false;

        // diagonal
        switch (row) {
            case 0:
                if (col != 0 && board.getMark(2, 0) == oM && board.getMark(1, 1) == oM)
                    return true;
                else if (board.getMark(2, 2) == oM && board.getMark(1, 1) == oM)
```

```
                    return true;
                break;
            case 1:
                if ((board.getMark(0, 0) == oM && board.getMark(2, 2) == oM) ||
                    (board.getMark(0, 2) == oM && board.getMark(2, 0) == oM))
                    return true;
                break;
            case 2:
                if (col != 0 && board.getMark(0, 0) == oM && board.getMark(1, 1) == oM)
                    return true;
                else if (board.getMark(0, 2) == oM && board.getMark(1, 1) == oM)
                    return true;
                break;
        }
        return false;
    }
}
```

Board.java

```
import java.io.PrintWriter;

// Board.java
// ENSF 409 - LAB 3 - Ex. C
// This file was originally written for ENGG 335 in fall 2001, and was
// adapted for ENSF 409 in 2014
//

/**
 * Provides a tic-tac-toe board and logic to fill, empty, and test if a player has won.
 * @author Originally written by Mahmood Moussavi, modified by Mitchell Sawatzky and Connor Newman
 * @version 1.0
 * @since Originally written in fall 2001, adapted in 2014, modified in 2016
 */
public class Board implements Constants {
    /**
     * Two-Dimensional char array to hold the values of each slot on the board
     */
        private char theBoard[][];

    /**
     * The total number of slots filled in on the board.
     */
        private int markCount;

    /**
     * Constructs a Board object without any spaces filled in.
     */
        public Board() {
                markCount = 0;
                theBoard = new char[3][];
                for (int i = 0; i < 3; i++) {
                        theBoard[i] = new char[3];
                        for (int j = 0; j < 3; j++)
                                theBoard[i][j] = SPACE_CHAR;
                }
        }

    /**
     * Returns the value of a board slot at a given row and column.
     * @param row the row to retrieve the board slot from
     * @param col the column to retrieve the board slot from
     * @return the Character value of the board slot
     */
        public char getMark(int row, int col) {
                return theBoard[row][col];
        }

    /**
     * Returns whether or not the board has values in all 9 slots.
     * @return True if all 9 slots are full, False otherwise
     */
        public boolean isFull() {
                return markCount == 9;
        }

    /**
     * Checks whether or not the letter X has won on the current board.
     * @return 0 if X has not won, 1 otherwise
     */
        public int xWins() {
                return checkWinner(LETTER_X);
        }

    /**
```

```
 * Checks whether or not the letter O has won on the current board.
 * @return 0 if O has not won, 1 otherwise
 */
    public int oWins() {
            return checkWinner(LETTER_O);
    }

/**
 * Prints the board to stdout.
 * @param out the stream to output the board to
 */
    public void display(PrintWriter out) {
            displayColumnHeaders(out);
            addHyphens(out);
            for (int row = 0; row < 3; row++) {
                    addSpaces(out);
                    out.print("P     row " + row + ' ');
                    for (int col = 0; col < 3; col++)
                            out.print("|  " + getMark(row, col) + "  ");
                    out.println("|");
                    addSpaces(out);
                    addHyphens(out);
            }
    }

/**
 * Sets the value of the board slot at a given row and column.
 * @param row the row to set the slot value
 * @param col the column to set the slot value
 * @param mark the Character to set the slot to
 */
    public void addMark(int row, int col, char mark) {
            theBoard[row][col] = mark;
            markCount++;
    }

/**
 * Resets every value on the board to SPACE_CHAR.
 */
    public void clear() {
            for (int i = 0; i < 3; i++)
                    for (int j = 0; j < 3; j++)
```

```
                            theBoard[i][j] = SPACE_CHAR;
            markCount = 0;
    }

/**
 * Uses tic-tac-toe logic to determine if a specific player has won.
 * @param mark the player to check, either LETTER_X or LETTER_O
 * @return 0 if the player has lost, 1 otherwise
 */
    int checkWinner(char mark) {
            int row, col;
            int result = 0;

            for (row = 0; result == 0 && row < 3; row++) {
                    int row_result = 1;
                    for (col = 0; row_result == 1 && col < 3; col++)
                            if (theBoard[row][col] != mark)
                                    row_result = 0;
                    if (row_result != 0)
                            result = 1;
            }


            for (col = 0; result == 0 && col < 3; col++) {
                    int col_result = 1;
                    for (row = 0; col_result != 0 && row < 3; row++)
                            if (theBoard[row][col] != mark)
                                    col_result = 0;
                    if (col_result != 0)
                            result = 1;
            }

            if (result == 0) {
                    int diag1Result = 1;
                    for (row = 0; diag1Result != 0 && row < 3; row++)
                            if (theBoard[row][row] != mark)
                                    diag1Result = 0;
                    if (diag1Result != 0)
                            result = 1;
            }
            if (result == 0) {
                    int diag2Result = 1;
                    for (row = 0; diag2Result != 0 && row < 3; row++)
                            if (theBoard[row][3 - 1 - row] != mark)
                                    diag2Result = 0;
                    if (diag2Result != 0)
                            result = 1;
            }
            return result;
    }

/**
 * Print the board's column headers to stdout.
 * @param out the stream to output the board to
 */
    void displayColumnHeaders(PrintWriter out) {
            out.print("P           ");
            for (int j = 0; j < 3; j++)
                    out.print("|col " + j);
            out.println();
    }

/**
 * Adds a line to separate the board's rows.
 * @param out the stream to output the board to
 */
    void addHyphens(PrintWriter out) {
            out.print("P           ");
            for (int j = 0; j < 3; j++)
                    out.print("+-----");
            out.println("+");
    }

/**
 * Adds spacing inside the board to correctly place the values of the slots.
 * @param out the stream to output the board to
 */
    void addSpaces(PrintWriter out) {
            out.print("P           ");
            for (int j = 0; j < 3; j++)
                    out.print("|     ");
            out.println("|");
    }
```

```
}
```

Constants.java

```
//Constants.java


/**
 * Provides constants to the rest of the Package.
 * @version 1.0
 * @author Originally written by Mahmood Moussavi, modified by Mitchell Sawatzky and Connor Newman
 * @since Originally written in fall 2001, adapted in 2014, modified in 2016
 */
public interface Constants {
    /**
     * The character to use when the board slot is empty.
     */
        static final char SPACE_CHAR = ' ';

    /**
     * The character to use when Player O has entered into the board.
     */
        static final char LETTER_O = 'O';

    /**
     * The character to use when Player X has entered into the board.
     */
        static final char LETTER_X = 'X';
}
```

Game.java

```
//Game.java
import java.io.*;


/**
 * @author Started by: M. Moussavi
 * Completed by: Mitchell Sawatzky and Connor Newman
 * Asks the user to select a player type, creates the player, creates the board,
 * assigns a referee to the game, then initiates the game.
 */
public class Game implements Constants {


        /**
```

```
     * The board
     */
    private Board theBoard;

    /**
     * The referee
     */
    private Referee theRef;

    /**
     * creates a board for the game
     */
public Game( ) {
    theBoard  = new Board();

    }

/**
 * calls the referee method runTheGame
 * @param r refers to the appointed referee for the game
 * @throws IOException
 */
public void appointReferee(Referee r) throws IOException {
    theRef = r;
    theRef.runTheGame();
}

    /**
     * Creates the specified type of player indicated by the user.
     *
     * @param name player's name
     * @param mark player's mark (X or O)
     * @param board refers to the game board
     * @param sin refers to an input stream
     * @param sout refers to an output stream
     * @return a newly created player
     * @throws IOException
     */
    static public Player  create_player(String name, char mark, Board board,
                    BufferedReader sin, PrintWriter sout) throws IOException {
            // Get the player type.
            final int NUMBER_OF_TYPES = 4;
```

```
sout.println("P \nP What type of player is " + name + "?\nP ");
sout.println("P   1: human\nP " + "  2: Random Player\nP "
+ "  3: Blocking Player\nP " + "  4: Smart Player\nP ");
sout.println("I Please enter a number in the range 1-" + NUMBER_OF_TYPES + ": ");
int player_type = 0;

String input;
input = sin.readLine();
if (input == null || input.length() == 0) {
        player_type = -1;
} else {
        player_type = Integer.parseInt(input);
}
while (player_type < 1 || player_type > NUMBER_OF_TYPES) {
        sout.println("P Please try again.\nP ");
        sout.println("I Enter a number in the range 1-" +NUMBER_OF_TYPES + ": ");
        input = sin.readLine();
        if (input == null || input.length() == 0) {
                player_type = -1;
        } else {
                player_type = Integer.parseInt(input);
        }
}

// Create a specific type of Player
Player result = null;
switch(player_type) {
        case 1:
                result = new HumanPlayer(name, mark, board, sin, sout);
                break;
        case 2:
                result = new RandomPlayer(name, mark, board, sin, sout);
                break;
        case 3:
                result = new BlockingPlayer(name, mark, board, sin, sout);
                break;
        case 4:
                result = new SmartPlayer(name, mark, board, sin, sout);
                break;
        default:
                System.out.print ( "\nDefault case in switch should not be reached.\n"
                + "  Program terminated.\n");
```

```
                                System.exit(0);
                }
                return result;
        }

        /**
         * Starts a new game
         * @param p1sin the input stream for player 1
         * @param p1sout the output stream for player 1
         * @param p2sin the input stream for player 2
         * @param p2sout the output stream for player 2
         * @throws IOException
         */
        public void start (BufferedReader p1sin, PrintWriter p1sout, BufferedReader p2sin, PrintWriter
p2sout) throws IOException {
                Player xPlayer, oPlayer;
                p1sout.println("I Please enter the name of the \'X\' player.");
                String name = p1sin.readLine();
                while (name == null && name.length() != 0) {
                        p1sout.println("I Please try again: ");
                        name = p1sin.readLine();
                }
                xPlayer = Game.create_player(name, LETTER_X, theBoard, p1sin, p1sout);
                p2sout.println("I Please enter the name of the \'O\' player.");
                name = p2sin.readLine();
                while (name == null && name.length() != 0) {
                        p2sout.println("I Please try again: ");
                        name = p2sin.readLine();
                }
                oPlayer = Game.create_player(name, LETTER_O, theBoard, p2sin, p2sout);

                appointReferee(new Referee(theBoard, xPlayer, oPlayer));
        }
}
```

HumanPlayer.java

```
import java.io.BufferedReader;
import java.io.PrintWriter;

/**
 * Provides methods to gather input from stdin in order to play a game of tic tac toe.
 * @author Mitchell Sawatzky and Connor Newman
 * @version 1.0
 * @since Mar 2016
 */
public class HumanPlayer extends Player {

    /**
     * Constructs a HumanPlayer object with the specified name, mark, and board.
     * @param name the Player's name
     * @param mark the Player's mark
     * @param board the Board to play the game on
     * @param in the input stream
     * @param out the output stream
     */
    public HumanPlayer(String name, char mark, Board board, BufferedReader in, PrintWriter out) {
        super(name, mark, board, in, out);
    }

    /**
     * Starts a game of tic tac toe with this player as player X.
     * @throws IOException
     */
    public void play() throws java.io.IOException {
        String winner;
        Player p = this;
        while (true) {
            if (board.isFull()) {
                winner = "Nobody";
                break;
            } else if (board.xWins() == 1) {
                winner = name;
                break;
            } else if (board.oWins() == 1) {
                winner = opponent.name();
                break;
            }
            board.display(p.sout);
            p.makeMove();
            p = p.opponent;
        }
        sout.printf("P \nP THE GAME IS OVER: %s is the winner!\n", winner);
        opponent.sout.printf("P \nP THE GAME IS OVER: %s is the winner!\n", winner);
        sout.println("Q");
        opponent.sout.println("Q");
        sout.close();
        sin.close();
        opponent.sout.close();
        opponent.sin.close();
        System.exit(0);
    }

    /**
     * Prompts the user via stdout to make a move on the tic tac toe Baord.
     * @throws IOException
     */
    public void makeMove() throws java.io.IOException {
        int row, col;
        Player p = this;

        while (true) {
            while (true) {
                String input = "";
                boolean success = true;
                do {
                    sout.printf("I %s, what row should your next %c be placed in?\n", p.name, p.mark);
                    input = sin.readLine();
                    try {
                        Integer.parseInt(input);
                        success = false;
                    } catch (NumberFormatException e) {
                    }
                } while (success);

                row = Integer.parseInt(input);
                if (row < 0 || row > 2)
                    sout.printf("P \nP Invalid row: %d, please try again.\n", row);
                else
                    break;
            }
            while (true) {
                String input = "";
                boolean success = true;
                do {
                    sout.printf("I %s, what column should your next %c be placed in?\n", p.name, p.mark);
                    input = sin.readLine();
                    try {
                        Integer.parseInt(input);
                        success = false;
                    } catch (NumberFormatException e) {
                    }
                } while (success);

                col = Integer.parseInt(input);
                if (col < 0 || col > 2)
                    sout.printf("P \nP Invalid row: %d, please try again.\n", col);
                else
                    break;
            }


            if (board.getMark(row, col) == SPACE_CHAR) {
                board.addMark(row, col, mark);
                break;
            } else {
                sout.printf("P \nP The coordinate (%d, %d) has already been used.\n", row, col);
            }
        }
    }
}
```

Player.java

```
//Player.java
import java.io.BufferedReader;
import java.io.PrintWriter;

/**
 * Provides a container to hold a Player's name and preferred mark (X or O), as well as logic prototypes.
 * @author Mitchell Sawatzky and Connor Newman
 * @version 1.0
 * @since Mar 5, 2016
 */
abstract class Player implements Constants {
    /**
     * The name of the player.
     */
    protected String name;
    /**
     * The player's mark, either 'X' or 'O'.
     */
    protected char mark;

    /**
     * The player's opponent.
     */
    protected Player opponent;

    /**
     * The Board to play the game on.
     */
    protected Board board;

    /**
     * The input stream
     */
    protected BufferedReader sin;

    /**
     * The output stream
     */
    protected PrintWriter sout;

    /**
     * Constructs a Player Object with a given name, mark, and Board.
     * @param name the Player's name
     * @param mark the Player's mark, either 'X' or 'O'
     * @param b the Board to play the game on
     * @param in the input stream
     * @param out the output stream
     */
    public Player(String name, char mark, Board b, BufferedReader in, PrintWriter out) {
        this.name = name;
        this.mark = mark;
        this.board = b;
        sin = in;
        sout = out;
    }

    /**
```

```
     * Getter function for the Player's name.
     * @return the String name of the Player
     */
    protected String name() {
        return name;
    }

    /**
     * Getter function for the Player's mark
     * @return the char mark of the Player
     */
    protected char mark() {
        return mark;
    }
    /**
     * Sets the opponent of a given Player to another Player.
     * @param opp the Player opponent
     */
    protected void setOpponent(Player other) {
        this.opponent = other;
    }

    /**
     * Initiate a game of tic-tac-toe with the opponent player.
     * @throws IOException
     */
    abstract protected void play() throws java.io.IOException;

    /**
     * Prompt the user to place their mark on a given board slot retrieved through stdin.
     * @Throws IOException
     */
    abstract protected void makeMove() throws java.io.IOException;
}
```

RandomGenerator.java

```
//  RandomGenerator.java

import java.util.Random;

/**
 * Provides a method to spawn a random integer.
 * @author M. Moussavi
 */
class RandomGenerator {

/**
 * creates a random number ranging between lo and hi,
 * @param lo the lower bound of the random integer
 * @param hi the upper bound of the random integer
 * @return the random integer
 */
        int discrete(int lo, int hi)
        {
                if(lo >= hi){
                        System.out.println("Error discrete, lo >= hi");
                        System.exit(0);
                }

                Random r = new Random();
                int d = r.nextInt(hi - lo + 1) + lo;
                return d;
        }

}
```

RandomPlayer.java

```
import java.io.BufferedReader;
import java.io.PrintWriter;
/**
 * Provides a tic tac toe robot that randomly chooses a space on every move.
 * @author Mitchell Sawatzky and Connor Newman
 * @version 1.0
 * @since Mar 2016
 */
public class RandomPlayer extends Player {

    /**
     * Constructs a RandomPlayer object with the specified name, mark, and board.
     * @param name the name of the player
     * @param mark the mark of the player
     * @param board the game board
     * @param in the input stream
     * @param out the output stream
     */
    public RandomPlayer(String name, char mark, Board board, BufferedReader in, PrintWriter out) {
        super(name, mark, board, in, out);
    }

    /**
     * Starts a game of tic tac toe with this player as player X.
     * @throws IOException
     */
    protected void play() throws java.io.IOException {
        String winner;
        Player p = this;
        while (true) {
            if (board.isFull()) {
                winner = "Nobody";
                break;
            } else if (board.xWins() == 1) {
                winner = p.name;
                break;
            } else if (board.oWins() == 1) {
                winner = p.opponent.name();
                break;
            }
            board.display(p.sout);
            p.makeMove();
            p = p.opponent;
        }
        sout.printf("P \nP THE GAME IS OVER: %s is the winner!\n", winner);
        opponent.sout.printf("P \nP THE GAME IS OVER: %s is the winner!\n", winner);
        sout.println("Q");
        opponent.sout.println("Q");
        sout.close();
        sin.close();
        opponent.sout.close();
        opponent.sin.close();
        System.exit(0);
    }

    /**
     * Picks a random board slot and makes a move there.
     */
    protected void makeMove() {
        RandomGenerator rand = new RandomGenerator();
        int row, col;

        do {
            row = rand.discrete(0, 2);
            col = rand.discrete(0, 2);
        } while (board.getMark(row, col) != SPACE_CHAR);

        board.addMark(row, col, mark);
    }
}
```

Referee.java

```
//Referee.java

/**
 * Mediates and controls a game of Tic Tac Toe.
 * Begins the game by printing the board, and then asks Player X to choose
 * @author Mitchell Sawatzky and Connor Newman
 * @version 1.0
 * @since Mar 5, 2016
 */
public class Referee {
    /**
     * Player X of the game.
     */
    private Player x;

    /**
     * Player O of the game.
     */
    private Player o;

    /**
     * The board to play on.
     */
    private Board b;

    /**
     * Construct a Referee object from Players and a Board.
     * @param board the Board for the referee to control
     * @param xPlayer the player with the mark 'X'
     * @param oPlayer the player with the mark 'O'
     */
    public Referee(Board board, Player xPlayer, Player oPlayer) {
        this.b = board;
        this.x = xPlayer;
        this.o = oPlayer;
    }

    /**
     * Initiate a game with Player X as the starting player.
     * @throws IOException
     */
    public void runTheGame() throws java.io.IOException {
        x.setOpponent(o);
        o.setOpponent(x);
        x.play();

        x.sout.println("\033[1mGame ended ...\033[0m");
        o.sout.println("\033[1mGame ended ...\033[0m");
    }
}
```

SmartPlayer.java

```
import java.io.BufferedReader;
import java.io.PrintWriter;
/**
 * Provides a tic tac toe robot that first checks it it can win, and then checks whether or not it can
block the opponent from winning.
 * @author Mitchell Sawatzky and Connor Newman
 * @version 1.0
 * @since Mar 2016
 */
public class SmartPlayer extends BlockingPlayer {


    /**
     * Constructs a SmartPlayer object with the specified name, mark, and board.
     * @param name the Player's name
     * @param mark the Player's mark
     * @param board the board to play the game on
     * @param in the input stream
     * @param out the output stream
     */
    public SmartPlayer(String name, char mark, Board board, BufferedReader in, PrintWriter out) {
        super(name, mark, board, in, out);
    }

    /**
     * First checks whether it can win the game, and then falls back to BlockingPlayer's logic to block
the opponent.
     */
    protected void makeMove() {
        for (int i = 0; i < 3; i++) {
            for (int j = 0; j < 3; j++) {
                if ((board.getMark(i, j) == SPACE_CHAR) && testForWinning(i, j)) {
                    board.addMark(i, j, mark);
                    return;
                }
            }
        }
        super.makeMove();
    }

    /**
     * Decides whether placing a mark in the specified row and column will win the getName
     * @param row the row to place the mark in
     * @param col the column to place the mark in
     * @return true if placing the mark wins the game, false otherwise
     */
    public boolean testForWinning(int row, int col) {
        boolean res = true;

        // row
        for (int i = 0; i < 3; i++) {
            if ((i != col) && (board.getMark(row, i) != mark)) {
                res = false;
                break;
            }
        }
        if (res)
            return true;

        // col
        res = true;
        for (int i = 0; i < 3; i++) {
            if ((i != row) && (board.getMark(i, col) != mark)) {
                res = false;
                break;
            }
        }
        if (res)
            return true;

        // can't be diagonal
        if ((row + col) % 2 != 0)
            return false;

        // diagonal
        switch (row) {
            case 0:
                if (col != 0 && board.getMark(2, 0) == mark && board.getMark(1, 1) == mark)
                    return true;
                else if (board.getMark(2, 2) == mark && board.getMark(1, 1) == mark)
                    return true;
                break;
            case 1:
                if ((board.getMark(0, 0) == mark && board.getMark(2, 2) == mark) ||
                    (board.getMark(0, 2) == mark && board.getMark(2, 0) == mark))
                    return true;
                break;
            case 2:
                if (col != 0 && board.getMark(0, 0) == mark && board.getMark(1, 1) == mark)
                    return true;
                else if (board.getMark(0, 2) == mark && board.getMark(1, 1) == mark)
                    return true;
                break;
        }
        return false;
    }
}
```

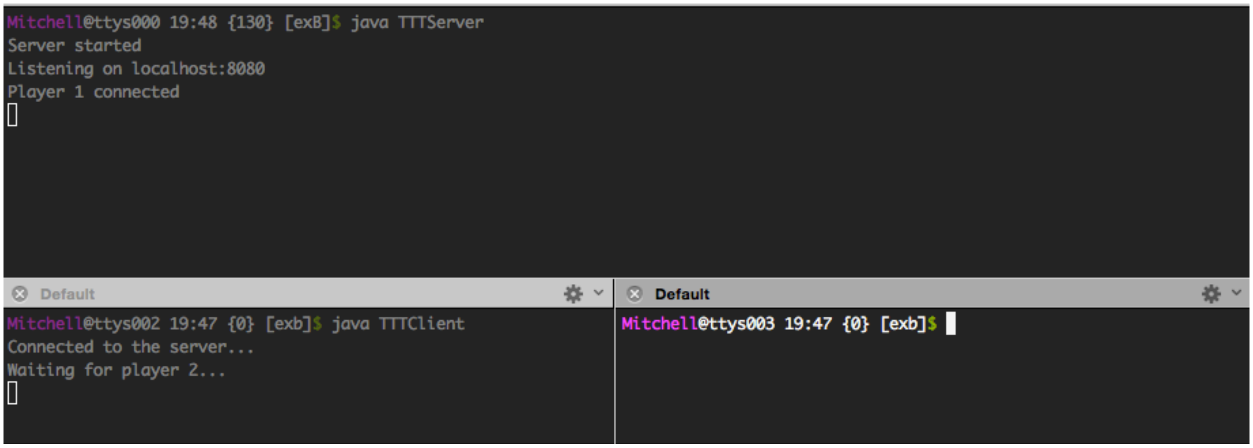
TTTClient.java

```
import java.io.BufferedReader;
import java.io.IOException;
import java.io.InputStreamReader;
import java.io.PrintWriter;
import java.net.Socket;
import java.net.UnknownHostException;

/**
 * Acts an an isolated client designed to interact with the TTTServer
 * @author Mitchell Sawatzky
 * @version 1.0
 * @since Mar 2016
 */
public class TTTClient {
    /**
     * The outgoing stream
     */
    private PrintWriter sOut;

    /**
     * The client socket
     */
    private Socket sock;

    /**
     * The incoming stream
     */
    private BufferedReader sIn;

    /**
     * A BufferedReader of stdin
     */
    private BufferedReader stdIn;

    /**
     * Constructs a TTTClient opject
     * @constructor
     */
    public TTTClient () {
        try {
            sock = new Socket("localhost", 8080);
            sIn = new BufferedReader(new InputStreamReader(sock.getInputStream()));
            sOut = new PrintWriter(sock.getOutputStream(), true);
            stdIn = new BufferedReader(new InputStreamReader(System.in));
            sOut.println("R");
        } catch (IOException e) {
            System.err.println("Unable to connect to localhost:8080");
            System.err.println(e.getStackTrace());
        }
    }

    /**
     * Logic for parsing server responses and instructions
     */
    public void parseServer () {
        String line = "";
        try {
            do {
                line = sIn.readLine();
                // System.out.println("server>> " + line);
                if (line != null) {
                    switch (line.substring(0, 1)) {
                        case "R": // READY
                            System.out.println("Connected to the server...");
                            break;
                        case "I": // INPUT
                            System.out.println(line.substring(2, line.length()));
                            sOut.println(stdIn.readLine());
                            break;
                        case "P": // PRINT
                            System.out.println(line.substring(2, line.length()));
                            break;
                        case "S": // Server full
                            System.out.println(line);
                            line = "QUIT";
                            break;
                        case "Q":
                            line = "QUIT";
                            break;
                    }
                } else {
                    System.out.println("The server disconnected you.");
                    line = "QUIT";
                }
            } while (line != "QUIT");
            sIn.close();
            sOut.close();
            stdIn.close();
        } catch (IOException e) {
            System.err.println(e.getStackTrace());
        }
    }

    /**
     * Program entry point
     * @param argv the command line arguments
     */
    public static void main (String[] argv) {
        TTTClient cli = new TTTClient();
        cli.parseServer();
    }
}
```

TTTServer.java

```
import java.io.BufferedReader;
import java.io.IOException;
import java.io.InputStreamReader;
import java.io.PrintWriter;
import java.net.ServerSocket;
import java.net.Socket;

/**
 * Server for a game of Tic Tac Toe
 * @author Mitchell Sawatzky
 * @version 1.0
 * @since Mar, 2016
 */
public class TTTServer implements Constants {
    /**
     * The server socket
     */
    private ServerSocket sSock;

    /**
     * A ServerConnection for player 1
     */
    protected ServerConnection p1 = null;

    /**
     * A ServerConnection for player 2
     */
    protected ServerConnection p2 = null;

    /**
     * Thread wrapper for each connection
     * @author Mitchell Sawatzky
     * @since Mar, 2016
     * @version 1.0
     */
    private class ServerConnection implements Runnable {
        /**
         * The output stream
         */
        private PrintWriter sOut;

        /**
         * The input stream
         */
        private BufferedReader sIn;

        /**
         * The client socket
         */
        private Socket sock;

        /**
         * Whether or not this is player 1
         */
        private boolean playerOne;

        /**
         * Constructs a ServerConnection ovject with a socket
         * @constructor
         * @param s the client socket
         * @param pOne if this connection is player 1
         * @throws IOException
         */
        private ServerConnection (Socket s, boolean pOne) throws IOException {
            sock = s;
            sIn = new BufferedReader(new InputStreamReader(s.getInputStream()));
            sOut = new PrintWriter(s.getOutputStream(), true);
            playerOne = pOne;
        }
```

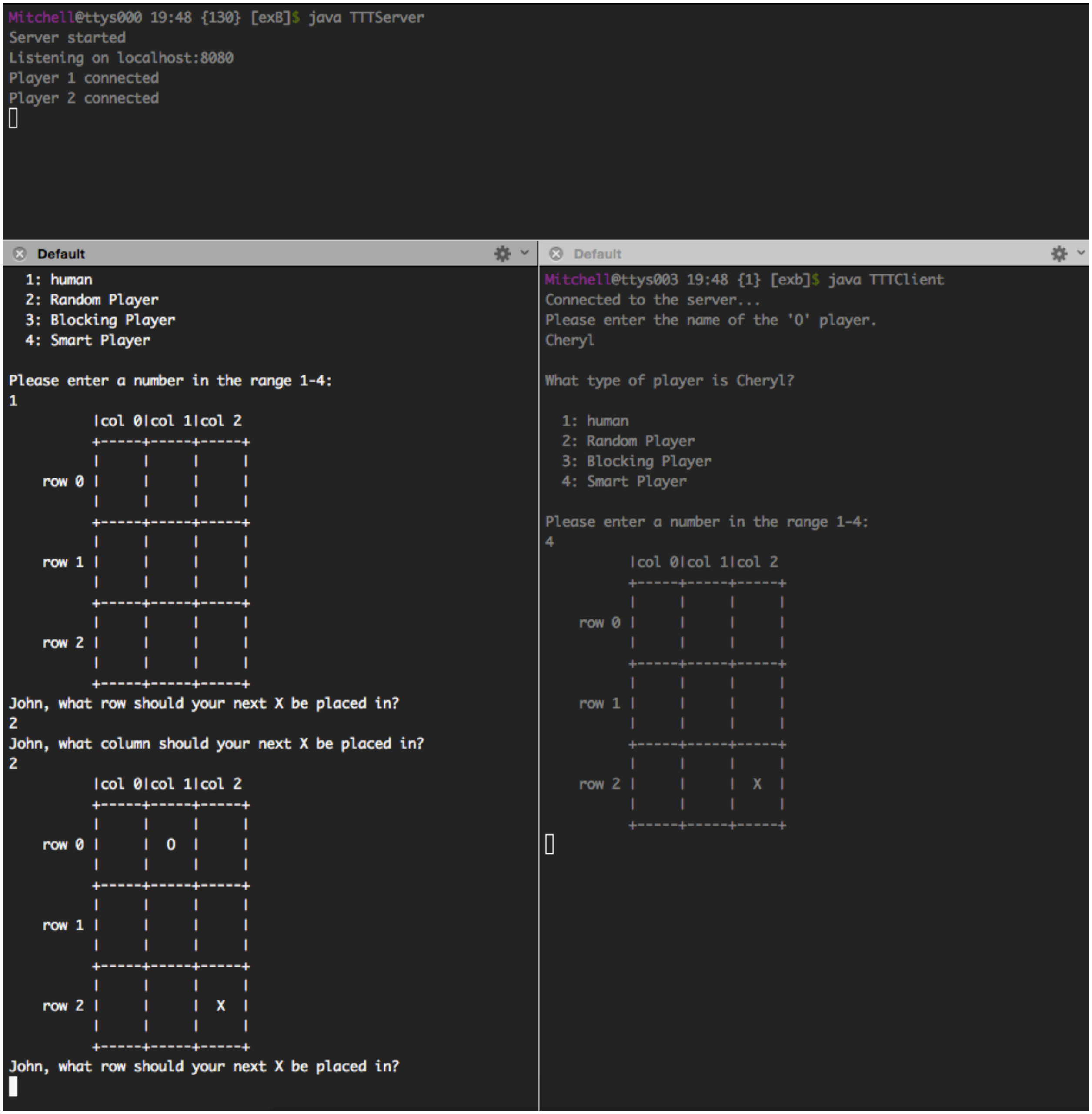
```java
    /**
     * Thread entry point
     */
    public void run () {
        try {
            String line = "";
            do {
                try {
                    line = sIn.readLine();
                    if (line == null) {
                        throw new Exception();
                    }
                } catch (Exception e) {
                    System.out.println((playerOne ? "p1" : "p2") + " disconnected...");
                    sIn.close();
                    sOut.close();
                    if (playerOne) {
                        p1 = null;
                    } else {
                        p2 = null;
                    }
                }
                // System.out.println((playerOne ? "p1" : "p2" ) + ">> " + line);
                sOut.println("R");
                if (playerOne) {
                        sOut.println("P Waiting for player 2...");
                } else {
                    Game theGame = new Game();
                    try {
                        theGame.start(p1.sIn, p1.sOut, sIn, sOut);
                    } catch (IOException e) {
                        sIn.close();
                        sOut.close();
                        p1.sIn.close();
                        p1.sOut.close();
                        p1 = null;
                        p2 = null;
                    }
                    break;
                }
            } while (line == "R");
        } catch (IOException e) {
            System.err.println("Error closing connection");
            System.err.println(e.getStackTrace());
        }
    }
}

/**
 * Constructs a TTTServer object
 * @constructor
 */
public TTTServer () {
    try {
        sSock = new ServerSocket(8080);
        System.out.println("Server started");
    } catch (IOException e) {
        System.err.println("Could not start server on localhost:8080");
        System.err.println(e.getStackTrace());
    }
}

/**
 * Program entry point
 * @param argv the command line arguments
 */
public static void main (String[] argv) {
    TTTServer server = new TTTServer();
    server.listen();
}

/**
 * Listen for new connections to the server
 */
public void listen () {
    System.out.println("Listening on localhost:8080");
    while (true) {
        try {
            Socket s = sSock.accept();
            if (p1 == null) {
                p1 = new ServerConnection(s, true);
                System.out.println("Player 1 connected");
                Thread t = new Thread(p1);
                t.start();
            } else if (p2 == null) {
                p2 = new ServerConnection(s, false);
                System.out.println("Player 2 connected");
                Thread t = new Thread(p2);
                t.start();
            } else {
                try {
                    PrintWriter reject = new PrintWriter(s.getOutputStream(), true);
                    reject.println("Sorry, this server is full.");
                    s.close();
                    reject.close();
                    System.out.println("Rejected a player");
                } catch (IOException e) {
                    System.err.println("Error rejecting connection");
                    System.err.println(e.getStackTrace());
                }
            }
        } catch (IOException e) {
            System.err.println("Error establishing new client");
            System.err.println(e.getStackTrace());
        }
    }
}


}
```



```
Mitchell@ttys000 19:48 {130} [exB]$ java TTTServer
Server started
Listening on localhost:8080
Player 1 connected
```

```
Mitchell@ttys002 19:47 {0} [exb]$ java TTTClient
Connected to the server...
Waiting for player 2...
```

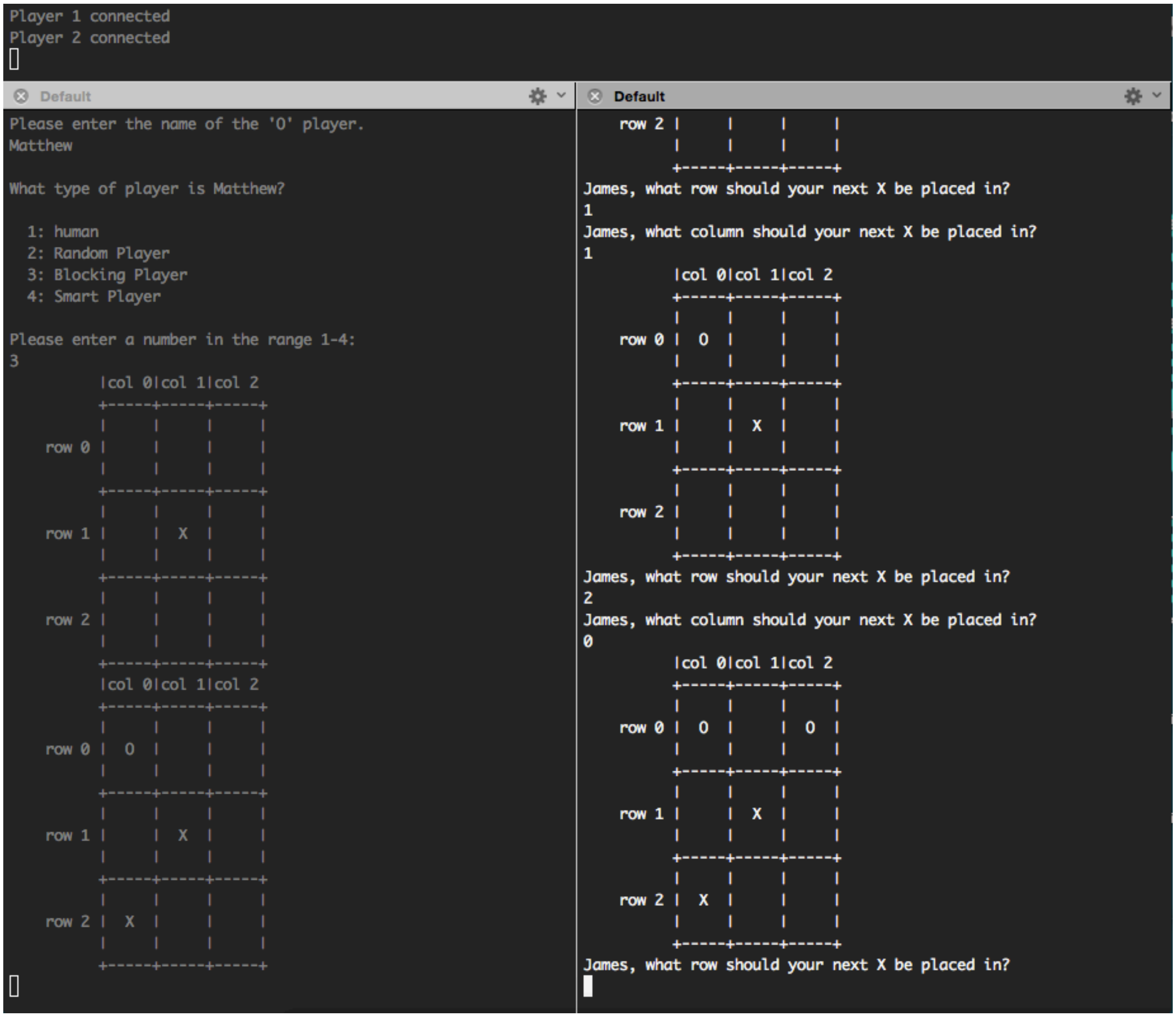
```
Mitchell@ttys003 19:47 {0} [exb]$
```



```
Mitchell@ttys000 19:48 {130} [exB]$ java TTTServer
Server started
Listening on localhost:8080
Player 1 connected
Player 2 connected
```

```
  1: human
  2: Random Player
  3: Blocking Player
  4: Smart Player

Please enter a number in the range 1-4:
1
          |col 0|col 1|col 2
          +-----+-----+-----+
          |     |     |     |
    row 0 |     |     |     |
          |     |     |     |
          +-----+-----+-----+
          |     |     |     |
    row 1 |     |     |     |
          |     |     |     |
          +-----+-----+-----+
          |     |     |     |
    row 2 |     |     |     |
          |     |     |     |
          +-----+-----+-----+
John, what row should your next X be placed in?
2
John, what column should your next X be placed in?
2
          |col 0|col 1|col 2
          +-----+-----+-----+
          |     |     |     |
    row 0 |     |  O  |     |
          |     |     |     |
          +-----+-----+-----+
          |     |     |     |
    row 1 |     |     |     |
          |     |     |     |
          +-----+-----+-----+
          |     |     |     |
    row 2 |     |     |  X  |
          |     |     |     |
          +-----+-----+-----+
John, what row should your next X be placed in?
```

```
Mitchell@ttys003 19:48 {1} [exb]$ java TTTClient
Connected to the server...
Please enter the name of the 'O' player.
Cheryl

What type of player is Cheryl?

  1: human
  2: Random Player
  3: Blocking Player
  4: Smart Player

Please enter a number in the range 1-4:
4
          |col 0|col 1|col 2
          +-----+-----+-----+
          |     |     |     |
    row 0 |     |     |     |
          |     |     |     |
          +-----+-----+-----+
          |     |     |     |
    row 1 |     |     |     |
          |     |     |     |
          +-----+-----+-----+
          |     |     |     |
    row 2 |     |     |  X  |
          |     |     |     |
          +-----+-----+-----+
```



```
Player 1 connected
Player 2 connected
```

```
Please enter the name of the 'O' player.
Matthew

What type of player is Matthew?

  1: human
  2: Random Player
  3: Blocking Player
  4: Smart Player

Please enter a number in the range 1-4:
3
          |col 0|col 1|col 2
          +-----+-----+-----+
          |     |     |     |
    row 0 |     |     |     |
          |     |     |     |
          +-----+-----+-----+
          |     |     |     |
    row 1 |     |  X  |     |
          |     |     |     |
          +-----+-----+-----+
          |     |     |     |
    row 2 |     |     |     |
          |     |     |     |
          +-----+-----+-----+
          |col 0|col 1|col 2
          +-----+-----+-----+
          |     |     |     |
    row 0 |  O  |     |     |
          |     |     |     |
          +-----+-----+-----+
          |     |     |     |
    row 1 |     |  X  |     |
          |     |     |     |
          +-----+-----+-----+
          |     |     |     |
    row 2 |  X  |     |     |
          |     |     |     |
          +-----+-----+-----+
```

```
    row 2 |     |     |     |
          |     |     |     |
          +-----+-----+-----+
James, what row should your next X be placed in?
1
James, what column should your next X be placed in?
1
          |col 0|col 1|col 2
          +-----+-----+-----+
          |     |     |     |
    row 0 |  O  |     |     |
          |     |     |     |
          +-----+-----+-----+
          |     |     |     |
    row 1 |     |  X  |     |
          |     |     |     |
          +-----+-----+-----+
          |     |     |     |
    row 2 |     |     |     |
          |     |     |     |
          +-----+-----+-----+
James, what row should your next X be placed in?
2
James, what column should your next X be placed in?
0
          |col 0|col 1|col 2
          +-----+-----+-----+
          |     |     |     |
    row 0 |  O  |     |  O  |
          |     |     |     |
          +-----+-----+-----+
          |     |     |     |
    row 1 |     |  X  |     |
          |     |     |     |
          +-----+-----+-----+
          |     |     |     |
    row 2 |  X  |     |     |
          |     |     |     |
          +-----+-----+-----+
James, what row should your next X be placed in?
```