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Project 5 Extended Tic Tac Toe

CpSc 2150 Section 001

Extended Tic Tac Toe Report

Requirements Analysis

User Stories (Functional):

As a user, I should be able to:

-decide how many players will be playing the game (min:2,max:10) so that the game will be set up properly

-decide what character/letter I want to be represented by so that I have a team marker

-decide how many rows will be present on the game board so that I can customize the game

-decide how many columns will be present on the game board so that I can customize the game

-decide how many in a row a player needs to win the game so that I have control over how complex the game can be

-pick my row so that my token will be placed on that row

-pick my column so that my token will be placed on that column

-place my marker in the positions previously chosen

-view the entire board after each turn so that I can plan for next turn

-pick a new board position if the position I choose is out of range

-win the game and ask to play again

-end the game in a tie and ask to play again

-lose the game and ask to play again

Non-Functional:

As a system, it should be able to:

-This systems code was written in Java and must be able to be compiled and ran on Unix.

-The system will construct a board that is the size of the player's choice

-The player will choose the amount of rows, columns, and number in a row to win

-The system will run until either a player wins, or there is a tie, then will be prompted to play again or not.

-The system will continue to run even if the user inputs an invalid integer.

-The system will ask the user for a new input if input was invalid.

-The system reads in the inputs from the players, and adequately assigns their move to the correct row and column.

-The system will update the gameboard after each turn to properly display where the tokens are placed.

-The system will check to see if there is a winner Vertically by having whatthe user inputted in a row and column.

-The system will check to see if there is a winner Horizontally by having what the user inputted in a row and column.

-The system will check to see if there is a winner Diagonally by having whatthe user inputted in a row and column.

-The system will display a message saying who won, if there is a winner.

-The system will display a message if a tie occurs.

-The system will prompt the user to play again or not.

Test Case Description – Expected Output

Constructor Tests

-Row Constructor Test

Input: Empty GameBoard of size 3 rows, 3 columns, numWin = 3

State of GameBoard:

	0	1	2
0			
1			
2			

Output: Rows = 3

State of GameBoard:

	0	1	2
0			
1			
2			

Reason: This tests that the constructor correctly creates a GameBoard with the specified number of rows

-Column Constructor Test

Input: Empty GameBoard of size 3 rows, 3 columns, numWin = 3

State of GameBoard:

	0	1	2
0			
1			
2			

Output: Columns = 3

State of GameBoard:

	0	1	2
0			
1			
2			

Reason: This tests that the constructor correctly creates a GameBoard with the specified number of columns

-Num to Win Constructor Test

Input: Empty GameBoard of size 3 rows, 3 columns, numWin = 3

State of GameBoard:

	0	1	2
0			
1			
2			

Output: Num to Win = 3

State of GameBoard:

	0	1	2
0			
1			
2			

Reason: This tests that the constructor correctly creates a GameBoard with the specified number to win equal to the constructor's number using a getter

<u>CheckSpace Tests</u>

-Column Filled, Check Last Row

Input: GameBoard size [3][3]

X markers placed in [0][0] and [2][0]

O marker placed in [1][0]

Checking space [2][0]

State of GameBoard:

	0	1	2
0	X		
1	O		
2	X		

Output: CheckSpace at [2][0] is false, space not available

State of GameBoard:

	0	1	2
0	X		
1	O		
2	X		

Reason: This tests that the checkSpace function can determine that the space in the last row and first column is filled and is not available

-No marker placed, checking empty spot

Input: GameBoard size [3][3]

No markers placed

Checking space [0][0]

State of GameBoard:

	0	1	2
0			
1			
2			

Output: CheckSpace at [0][0] is true, space is open

State of GameBoard:

	0	1	2
0			
1			
2			

Reason: This tests that the checkSpace function can determine that the space in the last first and first column is unfilled and available

-Last space filled, Check Last Row, Last Column

Input: GameBoard size [3][3]

X markers placed in [2][2]

Checking space [2][2]

State of GameBoard:

	0	1	2
0			
1			
2			X

Output: CheckSpace at [2][2] is false, space not available

State of GameBoard:

	0	1	2
0			
1			
2			X

Reason: This tests that the checkSpace function can determine that the space in the last row and last column is filled and is not available

CheckHorizontalWin Tests

-Last Row win

Input: GameBoard size [3][3]

X markers placed in [2][0] and [2][1] and [2][2]

Checking space [2][2]

State of GameBoard:

	0	1	2
0			
1			
2	X	X	X

Output: CheckHorizontalWin at [2][2] is true

State of GameBoard:

	0	1	2
0			
1			
2	X	X	X

Reason: This tests that the checkHorizontalWin function is working properly in the last row of the board

-First Row win

Input: GameBoard size [3][3]

X markers placed in [0][0] and [0][1] and [0][2]

Checking space [0][2]

State of GameBoard:

	0	1	2
0	X	X	X
1			
2			

Output: CheckHorizontalWin at [0][2] is true

State of GameBoard:

	0	1	2
0	X	X	X
1			
2			

Reason: This tests that the checkHorizontalWin function is working properly in the first row of the board

-Last Row win in larger board

Input: GameBoard size [5][5]

X markers placed in [4][1] and [4][2] and [4][3]

Checking space [4][3]

State of GameBoard:

	0	1	2	3	4
0					
1					
2					
3					
4		X	X	X	

Output: CheckHorizontalWin at [4][3] is true

State of GameBoard:

	0	1	2	3	4
0					
1					
2					
3					
4		X	X	X	

Reason: This tests that the checkHorizontalWin function is working properly in the last row of the board, center orientation, and on a larger board

-Last Row, Bottom Left

Input: GameBoard size [3][3]

X markers placed in [2][0] and [2][1] and [2][2]

Checking space [2][0]

State of GameBoard:

	0	1	2
0			
1			
2	X	X	X

Output: CheckHorizontalWin at [2][0] is true

State of GameBoard:

	0	1	2
0			
1			
2	X	X	X

Reason: This tests that the checkHorizontalWin function is working properly in the last row of the board by checking the furthest left space

<u>CheckVerticalWin Tests</u>

-Middle Column win, testing 3 num win

Input: GameBoard size [3][3]

X markers placed in [0][1] and [1][1] and [2][1]

Checking space [2][1]

State of GameBoard:

	0	1	2
0		X	
1		X	
2		X	

Output: CheckVerticalWin at [2][1] is true

State of GameBoard:

	0	1	2
0		X	
1		X	
2		X	

Reason: This tests that the CheckVerticalWin function is working properly in the middle column of the board

-First Column win

Input: GameBoard size [3][3]

X markers placed in [0][0] and [1][0] and [2][0]

Checking space [0][0]

State of GameBoard:

	0	1	2
0	X		
1	X		
2	X		

Output: CheckVerticalWin at [0][0] is true

State of GameBoard:

	0	1	2
0	X		
1	X		
2	X		

Reason: This tests that the CheckVerticalWin function is working properly in the first column of the board

-Last Column win, checking last space

Input: GameBoard size [3][3]

X markers placed in [0][2] and [1][2] and [2][2]

Checking space [2][2]

State of GameBoard:

	0	1	2
0			X
1			X
2			X

Output: CheckVerticalWin at [2][2] is true

State of GameBoard:

	0	1	2
0			X
1			X
2			X

Reason: This tests that the CheckVerticalWin function is working properly in the last row of the board

-First column win, last row check

Input: GameBoard size [3][3]

X markers placed in [0][0] and [1][0] and [2][0]

Checking space [0][2]

State of GameBoard:

	0	1	2
0	X		
1	X		
2	X		

Output: CheckVerticalWin at [2][0] is true

State of GameBoard:

	0	1	2
0	X		
1	X		
2	X		

Reason: This tests that the CheckVerticalWin function is working properly in the first column of the board, last space available

<u>CheckDiagonalWin Tests</u>

-Forward win

Input: GameBoard size [3][3]

X markers placed in [0][0] and [1][1] and [2][2]

Checking space [2][2]

State of GameBoard:

	0	1	2
0	X		
1		X	
2			X

Output: CheckDiagonalWin at [2][2] is true

State of GameBoard:

	0	1	2
0	X		
1		X	
2			X

Reason: This tests that the CheckDiagonalWin function is working properly in the going forward on the final space of the board

-Backward win

Input: GameBoard size [3][3]

X markers placed in [0][2] and [1][1] and [2][0]

Checking space [2][0]

State of GameBoard:

	0	1	2
0			X
1		X	
2	X		

Output: CheckDiagonalWin at [2][0] is true

State of GameBoard:

	0	1	2
0			X
1		X	
2	X		

Reason: This tests that the CheckDiagonalWin function is working properly in the going backwards in the first column check of the board

-Forward win checking top left now

Input: GameBoard size [3][3]

X markers placed in [0][0] and [1][1] and [2][2]

Checking space [0][0]

State of GameBoard:

	0	1	2
0	X		
1		X	
2			X

Output: CheckDiagonalWin at [0][0] is true

State of GameBoard:

	0	1	2
0	X		
1		X	
2			X

Reason: This tests that the CheckDiagonalWin function is working properly in the by checking the top left and going down

-Top right going backward

Input: GameBoard size [3][3]

X markers placed in [0][2] and [1][1] and [2][0]

Checking space [0][2]

State of GameBoard:

	0	1	2
0			X
1		X	
2	X		

Output: CheckDiagonalWin at [0][2] is true

State of GameBoard:

	0	1	2
0			X
1		X	
2	X		

Reason: This tests that the CheckDiagonalWin function is working properly in the first row of the board going backward

-Bottom left backward

Input: GameBoard size [3][3]

X markers placed in [0][0] and [1][1] and [2][0]

Checking space [2][0]

State of GameBoard:

	0	1	2
0			X
1		X	
2	X		

Output: CheckDiagonalWin at [2][0] is true

State of GameBoard:

	0	1	2
0			X
1		X	
2	X		

Reason: This tests that the CheckDiagonalWin function is working properly in the last row of the board checking backward win

-Bottom Right forward

Input: GameBoard size [3][3]

X markers placed in [0][0] and [1][1] and [2][2]

Checking space [2][2]

State of GameBoard:

	0	1	2
0	X		
1		X	
2			X

Output: CheckDiagonalWin at [2][2] is true

State of GameBoard:

	0	1	2
0	X		
1		X	
2			X

Reason: This tests that the CheckDiagonalWin function is working properly in the bottom right of the board going forward

-No Diagonal win, not enough pieces

Input: GameBoard size [3][3]

X markers placed in [0][0] and [1][1]

Checking space [1][1]

State of GameBoard:

	0	1	2
0	X		
1		X	
2			

Output: CheckHorizontalWin at [1][1] is false

State of GameBoard:

	0	1	2
0	X		
1		X	
2			

Reason: This tests that the CheckDiagonalWin function is working properly in the by throwing a false when the diagonalwin is not complete

<u>CheckDraw Tests</u>

-Top left draw

Input: GameBoard size [3][3]

X markers placed in every spot on the board

Checking space [0][0]

State of GameBoard:

	0	1	2
0	X	X	X
1	X	X	X
2	X	X	X

Output: CheckDraw at [0][0] is true

State of GameBoard:

	0	1	2
0	X	X	X
1	X	X	X
2	X	X	X

Reason: This tests that the CheckDraw function is working properly in the first spot of the board

-Bottom left draw

Input: GameBoard size [3][3]

X markers placed in every spot on the board

Checking space [2][0]

State of GameBoard:

	0	1	2
0	X	X	X
1	X	X	X
2	X	X	X

Output: CheckDraw at [2][0] is true

State of GameBoard:

	0	1	2
0	X	X	X
1	X	X	X
2	X	X	X

Reason: This tests that the CheckDraw function is working properly in the first column, last row of the board

-Top right draw

Input: GameBoard size [3][3]

X markers placed in every spot on the board

Checking space [0][2]

State of GameBoard:

	0	1	2
0	X	X	X
1	X	X	X
2	X	X	X

Output: CheckDraw at [0][2] is true

State of GameBoard:

	0	1	2
0	X	X	X
1	X	X	X
2	X	X	X

Reason: This tests that the CheckDraw function is working properly in the first row and last column of the board

-Bottom right draw

Input: GameBoard size [3][3]

X markers placed in every spot on the board

Checking space [2][2]

State of GameBoard:

	0	1	2
0	X	X	X
1	X	X	X
2	X	X	X

Output: CheckDraw at [2][2] is true

State of GameBoard:

	0	1	2
0	X	X	X
1	X	X	X
2	X	X	X

Reason: This tests that the CheckDraw function is working properly in the last spot of the board

<u>WhatsAtPos Tests</u>

-Checking center of board

Input: GameBoard size [3][3]

X markers placed at [1][1]

Checking space [1][1]

State of GameBoard:

	0	1	2
0			
1		X	
2			

Output: WhatsAtPos at [1][1] returns player ‘X’

State of GameBoard:

	0	1	2
0			
1		X	
2			

Reason: This tests that the WhatsAtPos function is working properly by returning the character that is at the specified position in the center of the board

-Checking center of board returning different character

Input: GameBoard size [3][3]

X markers placed at [1][1]

Checking space [1][1]

State of GameBoard:

	0	1	2
0			
1		O	
2			

Output: WhatsAtPos at [1][1] returns player ‘O’

State of GameBoard:

	0	1	2
0			
1		O	
2			

Reason: This tests that the WhatsAtPos function is working properly by returning the character that is at the specified position in the center of the board

-Checking top left of board

Input: GameBoard size [3][3]

X markers placed at [0][0]

Checking space [0][0]

State of GameBoard:

	0	1	2
0	X		
1			
2			

Output: WhatsAtPos at [0][0] returns player ‘X’

State of GameBoard:

	0	1	2
0	X		
1			
2			

Reason: This tests that the WhatsAtPos function is working properly by returning the character that is at the specified position on the board

-Checking bottom left of board

Input: GameBoard size [3][3]

X markers placed at [2][0]

Checking space [2][0]

State of GameBoard:

	0	1	2
0			
1			
2	X		

Output: WhatsAtPos at [2][0] returns player ‘X’

State of GameBoard:

	0	1	2
0			
1			
2	X		

Reason: This tests that the WhatsAtPos function is working properly by returning the character that is at the specified position on the board

-Checking bottom right of board

Input: GameBoard size [3][3]

X markers placed at [2][2]

Checking space [2][2]

State of GameBoard:

	0	1	2
0			
1			
2			X

Output: WhatsAtPos at [2][2] returns player ‘X’

State of GameBoard:

	0	1	2
0			
1			
2			X

Reason: This tests that the WhatsAtPos function is working properly by returning the character that is at the specified position on the board

IsPlayerAtPos Tests

-Checking top left of board

Input: GameBoard size [3][3]

X markers placed at [0][0]

Checking space [0][0]

State of GameBoard:

	0	1	2
0	X		
1			
2			

Output: IsPlayerAtPos at [0][0] returns true

State of GameBoard:

	0	1	2
0	X		
1			
2			

Reason: This tests that the IsPlayerAtPos function is working properly by returning true if that player is at the specified position on the board

-Checking center of board

Input: GameBoard size [3][3]

X markers placed at [1][1]

Checking space [1][1]

State of GameBoard:

	0	1	2
0			
1		X	
2			

Output: IsPlayerAtPos at [1][1] returns true

State of GameBoard:

	0	1	2
0			
1		X	
2			

Reason: This tests that the IsPlayerAtPos function is working properly by returning true if that player is at the specified position on the board

-Checking bottom right of board

Input: GameBoard size [3][3]

X markers placed at [2][2]

Checking space [2][2]

State of GameBoard:

	0	1	2
0			
1			
2			X

Output: IsPlayerAtPos at [2][2] returns true

State of GameBoard:

	0	1	2
0			
1			
2			X

Reason: This tests that the IsPlayerAtPos function is working properly by returning true if that player is at the specified position on the board

-Checking center false

Input: GameBoard size [3][3]

Checking space [1][1]

State of GameBoard:

	0	1	2
0			
1			
2			

Output: IsPlayerAtPos at [1][1] returns false

State of GameBoard:

	0	1	2
0			
1			
2			

Reason: This tests that the IsPlayerAtPos function is working properly by returning false if that player is not at the specified position on the board

-Checking top left of board

Input: GameBoard size [3][3]

O markers placed at [1][1]

Checking space [1][1]

State of GameBoard:

	0	1	2
0			
1		O	
2			

Output: IsPlayerAtPos at [1][1] returns true

State of GameBoard:

	0	1	2
0			
1		O	
2			

Reason: This tests that the IsPlayerAtPos function is working properly by returning false if that player is not at the specified position on the board

<u>PlaceMarker Tests</u>

-Checking top left of board

Input: GameBoard size [3][3]

X markers placed at [0][0]

Checking space [0][0]

State of GameBoard:

	0	1	2
0	X		
1			
2			

Output: new marker placed at [0][0]

State of GameBoard:

	0	1	2
0	X		
1			
2			

Reason: This tests that the placeMarker function is working properly by placing the specified character at the location given on the board

-Checking top right of board

Input: GameBoard size [3][3]

X markers placed at [0][2]

Checking space [0][2]

State of GameBoard:

	0	1	2
0			X
1			
2			

Output: new marker placed at [0][2]

State of GameBoard:

	0	1	2
0			X
1			
2			

Reason: This tests that the placeMarker function is working properly by placing the specified character at the location given on the board

-Checking bottom left of board

Input: GameBoard size [3][3]

X markers placed at [2][0]

Checking space [2][0]

State of GameBoard:

	0	1	2
0			
1			
2	X		

Output: new marker placed at [2][0]

State of GameBoard:

	0	1	2
0			
1			
2	X		

Reason: This tests that the placeMarker function is working properly by placing the specified character at the location given on the board

-Checking bottom right of board

Input: GameBoard size [3][3]

X markers placed at [2][2]

Checking space [2][2]

State of GameBoard:

	0	1	2
0			
1			
2			X

Output: new marker placed at [2][2]

State of GameBoard:

	0	1	2
0			
1			
2			X

Reason: This tests that the placeMarker function is working properly by placing the specified character at the location given on the board

-Checking center of board with new character

Input: GameBoard size [3][3]

O markers placed at [1][1]

Checking space [1][1]

State of GameBoard:

	0	1	2
0			
1		O	
2			

Output: new marker placed at [1][1]

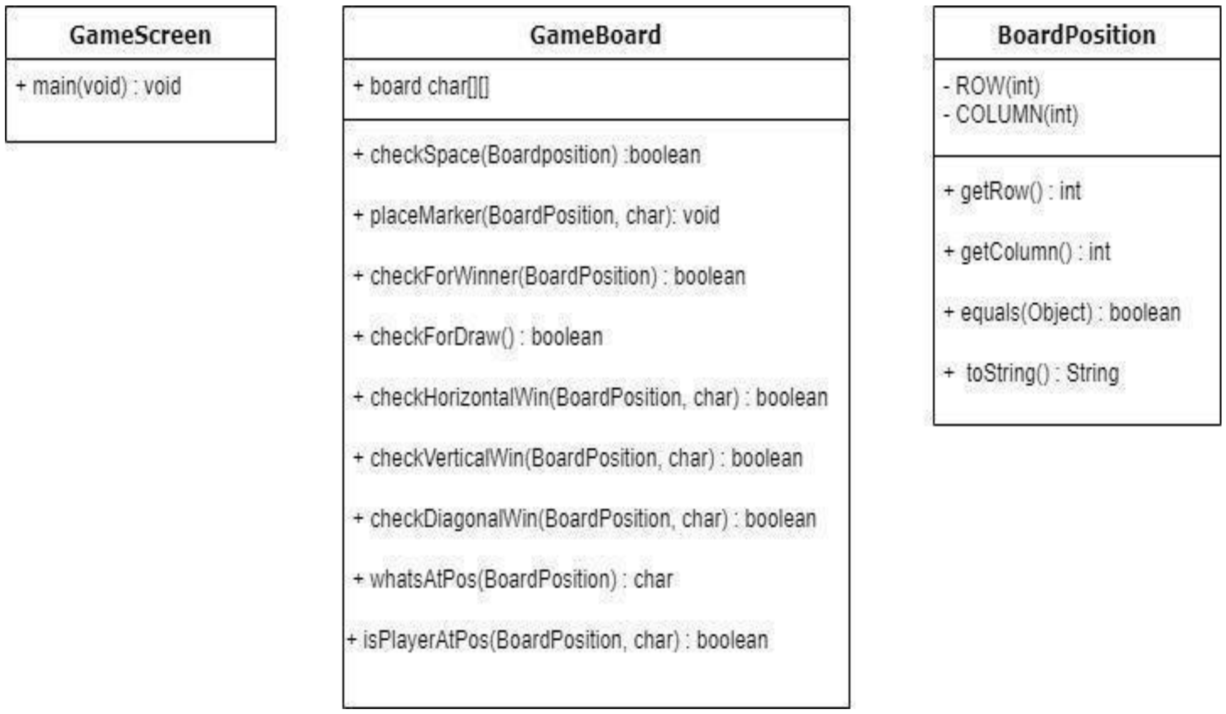
State of GameBoard:

	0	1	2
0			
1		O	
2			

Reason: This tests that the placeMarker function is working properly by placing the specified character at the location given on the board

Design

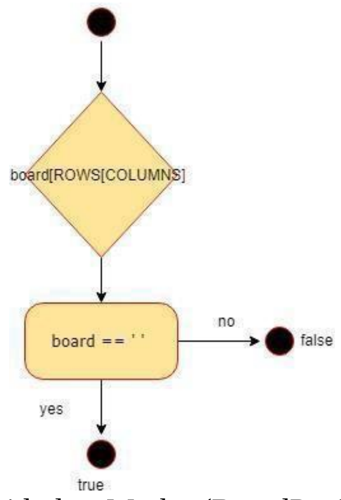
UML Class Diagrams:


GameScreen
+ main(void) : void
GameBoard
+ board char[][]
+ checkSpace(Boardposition) :boolean
+ placeMarker(BoardPosition, char): void
+ checkForWinner(BoardPosition) : boolean
+ checkForDraw() : boolean
+ checkHorizontalWin(BoardPosition, char) : boolean
+ checkVerticalWin(BoardPosition, char) : boolean
+ checkDiagonalWin(BoardPosition, char) : boolean
+ whatsAtPos(BoardPosition) : char
+ isPlayerAtPos(BoardPosition, char) : boolean
BoardPosition
- ROW(int)
- COLUMN(int)
+ getRow() : int
+ getColumn() : int
+ equals(Object) : boolean
+ toString() : String

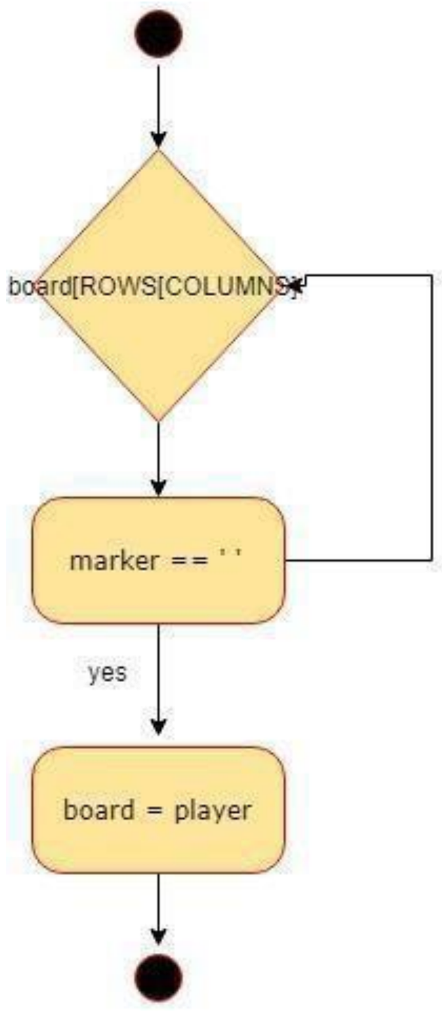
UML Activity Diagrams:

GameBoard.java

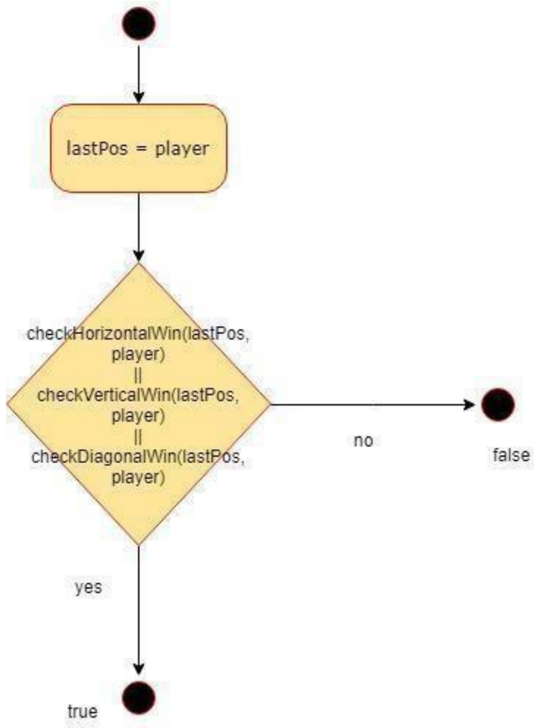
default boolean checkSpace(BoardPosition pos)



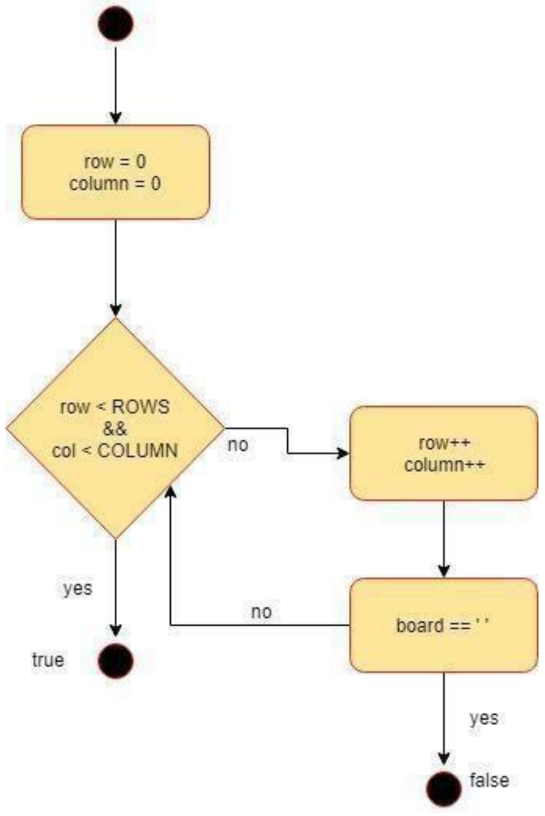
Public void placeMarker(BoardPosition marker, char player)



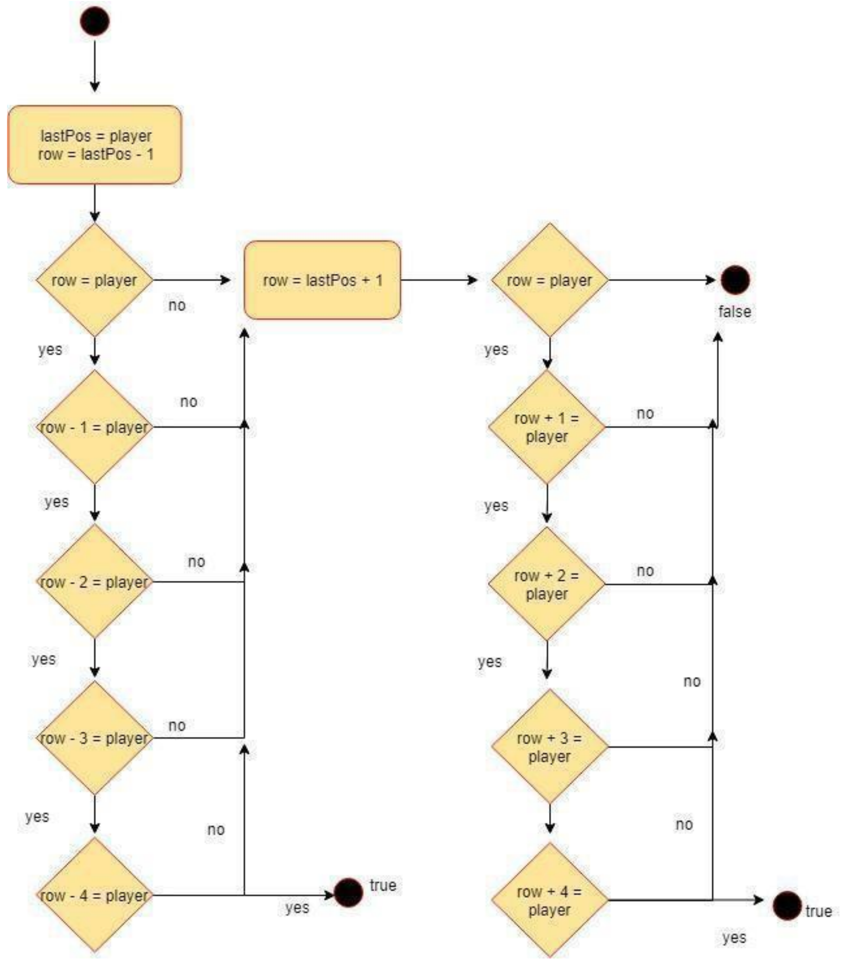
default boolean checkForWinner(BoardPosition lastPos)


lastPos = player
checkHorizontalWin(lastPos, player)
||
checkVerticalWin(lastPos, player)
||
checkDiagonalWin(lastPos, player)
no
false
yes
true

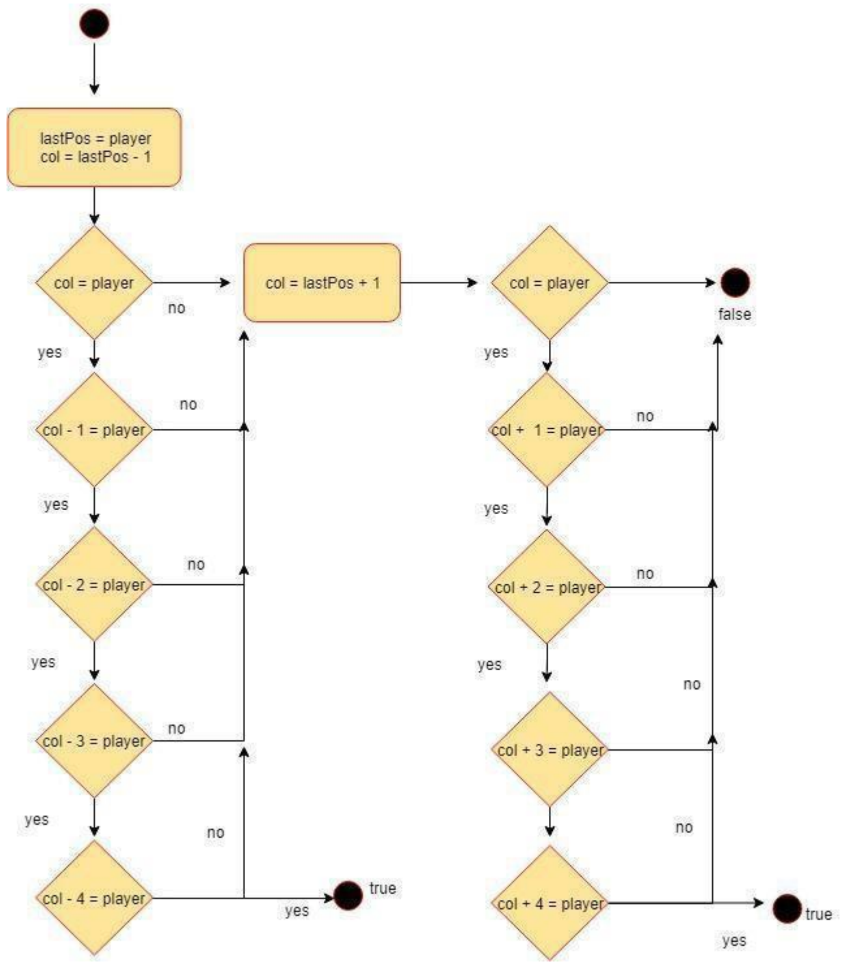
default boolean checkForDraw()



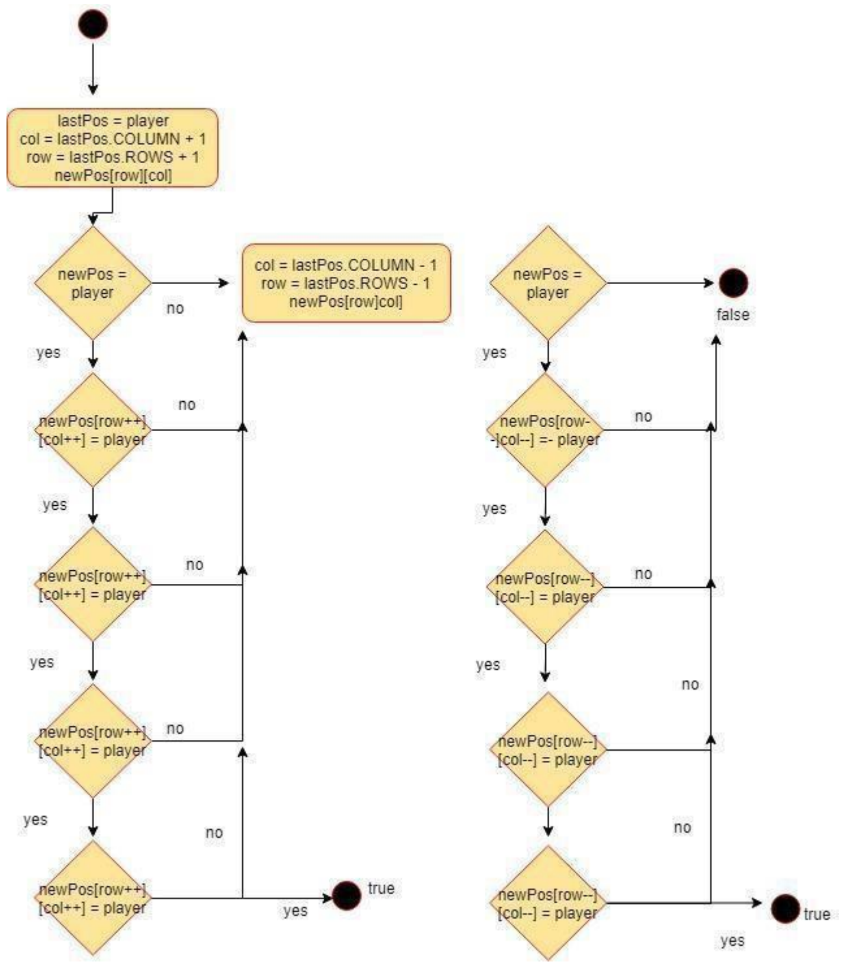
default boolean checkHorizontalWin(BoardPosition lastPos, char player)



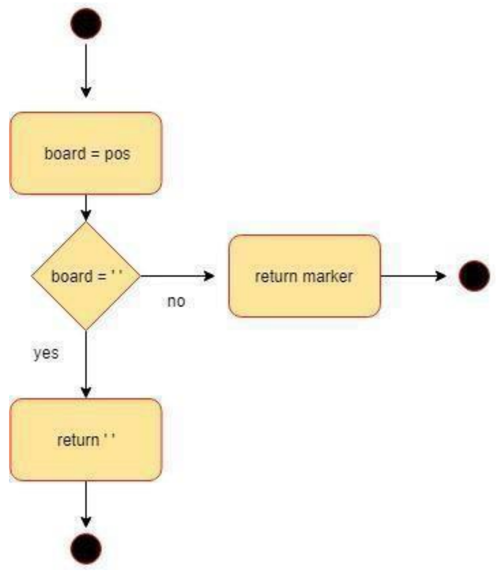
default boolean checkVerticalWin(BoardPosition lastPos, char player)



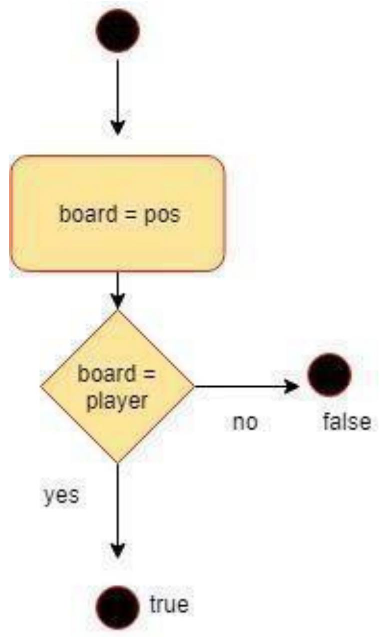
default boolean checkDiagonalWin(BoardPosition lastPos, char player)


lastPos = player
col = lastPos.COLUMN + 1
row = lastPos.ROWS + 1
newPos[row][col]
newPos = player
no
yes
col = lastPos.COLUMN - 1
row = lastPos.ROWS - 1
newPos[row]col]
newPos[row++][col++] = player
no
yes
newPos[row++][col++] = player
no
yes
newPos[row++][col++] = player
no
yes
no
newPos[row++][col++] = player
yes
true
newPos = player
false
yes
newPos[row--][col--] =- player
no
yes
newPos[row--][col--] = player
no
yes
no
newPos[row--][col--] = player
no
newPos[row--][col--] = player
yes
true

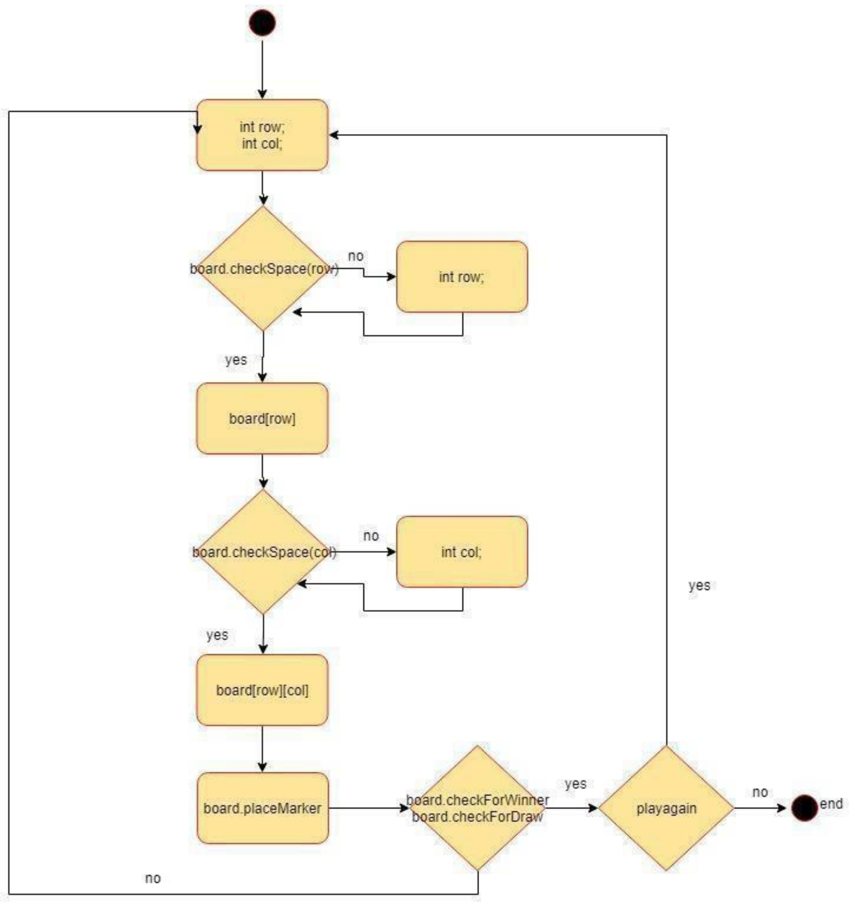
Public char whatsAtPos(BoardPosition pos)



default boolean isPlayerAtPos(BoardPosition pos, char player)



GAMESCREEN: public static void main(String [] args)


int row;
int col;
board.checkSpace(row)
no
int row;
yes
board[row]
board.checkSpace(col)
no
int col;
yes
board[row][col]
board.placeMarker
board.checkForWinner
board.checkForDraw
yes
playagain
no
end
yes
no