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CPSC 2150

Requirements Analysis

User Stories

- As a player, I want to be able to place a marker, so I can play Tic-Tac-Toe
- As a player, I want to be able to see the tic-tac-toe grid, so I can view the locations of the markers
- As a player, I want to know when one of the players has won, so I don't have to check after each turn
- As a player, I want to know if there has been a tie, so I don't have to check if there has been a tie
- As a player, I want to know whose turn it is, so I know who has to place their marker
- As a player, I want to know if I placed my marker on a spot that was already claimed, so that multiple players don't place their marker on the same spot.
- As a player, I want to be able to play again after the game ends, so I can play more games without starting the program again
- As a player, I want to be able to change the size of the board, so I can play with different board sizes
- As a player, I want to be able to change the number of markers in a row required to win, so I can change the win condition
- As a player, I want to be able to specify the amount of players, so I can play with however many people I want
- As a player, I want every player to have a different marker, so I don't get confused when playing.
- As a player, I want to be able to choose the amount of players after starting a new game, so I can change the amount of players without restarting the program.
- As a player, I want the program to have a GUI, so that I can easily play the game.

Non-Functional Requirements

- Must have a grid
- System must have a GUI
- System must be coded in Java
- System must follow Model View Controller architectural pattern.
- 2 <= number of players <= 10
- Player marker representations must be capitalized alphabetical characters
- Must have a fast implementation and a memory efficient implementation
- Player 1 must always be the first to play

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Constructor Tests

GameBoard(int num_rows, int num_cols, int win_req)

Input:	Output: N/A	Reason:
State: unitialized num_rows = MIN_ROWS num_cols = MIN_COLS win_req = MIN_WIN_REQ	State: 0 1 2 0 1 2	This test case is unique and distinct because it's a boundary test for the smallest possible game board you can construct. Function name: test_GameBoard_min_size

GameBoard(int num_rows, int num_cols, int win_req)

Input:	Output: N/A	Reason:
State: uninitialized num_rows = MAX_ROWS num_cols = MAX_COLS win_req = MAX_WIN_REQ	State: 0 ... 99 0 ... 99	This test case is unique and distinct because it's a boundary test for the largest possible game board you can construct. Function name: test_GameBoard_max_size

GameBoard(int num_rows, int num_cols, int win_req)

Input:	Output: N/A	Reason:
State: uninitialized num_rows = 5 num_cols = 7 win_req = MIN_WIN_REQ	State: 0 1 2 3 4 5 6 0 1 2 3 4	This test case is unique and distinct because it tests the ability for an NxM gameboard with N != M. Function name: test_GameBoard_different_rows_cols

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checkSpace Test

boolean checkSpace(BoardPosition pos)

Input:	Output:	Reason:
State: pos.getRow = 1 pos.getCol = 1	Output: false State: unchanged	This test case is unique and distinct because it tests checkSpace on a space which is already occupied. Function name: test_checkSpace_occupied

	0	1	2	3	4
0					
1		x			
2					
3					
4					

boolean checkSpace(BoardPosition pos)

Input:	Output:	Reason:
State: pos.getRow = 1 pos.getCol = 1	Output: true State: unchanged	This test case is unique and distinct because it tests checkSpace on a space which is not already occupied. Function name: test_checkSpace_unoccupied

	0	1	2	3	4
0					
1					
2					
3					
4					

boolean checkSpace(BoardPosition pos)

Input:	Output:	Reason:
State: pos.getRow = 5 pos.getCol = 1	Output: false State: unchanged	This test case is unique and distinct because it tests checkSpace on a space which is out of the bounds of the game board. Function name: test_checkSpace_out_of_bounds

	0	1	2	3	4
0					
1					
2					
3					
4					

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checkHorizontalWin Tests

boolean checkHorizontalWin(BoardPosition lastPos, char player)

Input:	Output:	Reason:
State: (win_req = 3) lastPos.getRow = 2 lastPos.getCol = 1 Player = x	Output: true State: unchanged	This test case is unique and distinct because lastPos is the leftmost marker in the winning row; therefore, it will have to check markers on the right of lastPos. Function name: test_checkHorizontalWin_win_start_left

	0	1	2	3	4
0					
1					
2		x	x	x	
3					
4					

boolean checkHorizontalWin(BoardPosition lastPos, char player)

Input:	Output:	Reason:
State: (win_req = 3) lastPos.getRow = 2 lastPos.getCol = 3 Player = x	Output: true State: unchanged	This test case is unique and distinct because lastPos is the rightmost marker in the winning row; therefore, it will have to check markers on the left of lastPos. Function name: test_checkHorizontalWin_win_start_right

	0	1	2	3	4
0					
1					
2		x	x	x	
3					
4					

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boolean checkHorizontalWin(BoardPosition lastPos, char player)

Input:	Output:	Reason:
State: (win_req = 3) lastPos.getRow = 2 lastPos.getCol = 2 Player = x	Output: true State: unchanged	This test case is unique and distinct because lastPos is the middlemost marker in the winning row; therefore, it will have to check markers on the left and right of lastPos. Function name: test_checkHorizontalWin_win_start_middle

	0	1	2	3	4
0					
1					
2		x	x	x	
3					
4					

boolean checkHorizontalWin(BoardPosition lastPos, char player)

Input:	Output:	Reason:
State: (win_req = 3) lastPos.getRow = 2 lastPos.getCol = 1 Player = x	Output: false State: unchanged	This test case is unique and distinct because there is a marker of another player interrupting the row of markers being checked; therefore, there is not a win. Function name: test_checkHorizontalWin_no_win_interrupt

	0	1	2	3	4
0					
1					
2		x	y	x	
3					
4					

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checkVerticalWin Tests

boolean checkVerticalWin(BoardPosition lastPos, char player)

Input:	Output:	Reason:
State: (win_req = 3) lastPos.getRow = 1 lastPos.getCol = 2 Player = x	Output: true State: unchanged	This test case is unique and distinct because lastPos is the uppermost marker in the winning column; therefore, it will have to check markers below lastPos. Function name: test_checkVerticalWin_win_start_top

	0	1	2	3	4
0					
1			x		
2			x		
3			x		
4					

boolean checkVerticalWin(BoardPosition lastPos, char player)

Input:	Output:	Reason:
State: (win_req = 3) lastPos.getRow = 3 lastPos.getCol = 2 Player = x	Output: true State: unchanged	This test case is unique and distinct because lastPos is the lowermost marker in the winning column; therefore, it will have to check markers above lastPos. Function name: test_checkVerticalWin_win_start_bottom

	0	1	2	3	4
0					
1			x		
2			x		
3			x		
4					

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boolean checkVerticalWin(BoardPosition lastPos, char player)

Input:	Output:	Reason:
State: (win_req = 3) lastPos.getRow = 2 lastPos.getCol = 2 Player = x	Output: true State: unchanged	This test case is unique and distinct because lastPos is the middlemost marker in the winning column; therefore, it will have to check markers below and above lastPos. Function name: test_checkVerticalWin_win_start_middle

	0	1	2	3	4
0					
1			x		
2			x		
3			x		
4					

boolean checkVerticalWin(BoardPosition lastPos, char player)

Input:	Output:	Reason:
State: (win_req = 3) lastPos.getRow = 1 lastPos.getCol = 2 Player = x	Output: false State: unchanged	This test case is unique and distinct because there is a marker of another player interrupting the column of markers being checked; therefore, there is not a win. Function name: test_checkVerticalWin_no_win_interrupt

	0	1	2	3	4
0					
1			x		
2			y		
3			x		
4					

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checkDiagonalWin Tests

boolean checkDiagonalWin(BoardPosition lastPos, char player)

Input:	Output:	Reason:
State: (win_req = 3) lastPos.getRow = 3 lastPos.getCol = 1 Player = x	Output: true State: unchanged	Reason: This test case is unique and distinct because lastPos is the lower-leftmost marker in the winning diagonal; therefore, it will have to check markers to the upper-right of lastPos. Function name: test_checkDiagonalWin_win_start_lower_left

	0	1	2	3	4
0					
1				x	
2			x		
3		x			
4					

boolean checkDiagonalWin(BoardPosition lastPos, char player)

Input:	Output:	Reason:
State: (win_req = 3) lastPos.getRow = 1 lastPos.getCol = 3 Player = x	Output: true State: unchanged	Reason: This test case is unique and distinct because lastPos is the upper-rightmost marker in the winning diagonal; therefore, it will have to check markers to the lower-left of lastPos. Function name: test_checkDiagonalWin_win_start_upper_right

	0	1	2	3	4
0					
1				x	
2			x		
3		x			
4					

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boolean checkDiagonalWin(BoardPosition lastPos, char player)

Input:	Output:	Reason:
State: (win_req = 3) lastPos.getRow = 2 lastPos.getCol = 2 Player = x	Output: true State: unchanged	This test case is unique and distinct because lastPos is the middlemost marker in the winning diagonal; therefore, it will have to check markers to the lower-left and upper-right of lastPos. Function name: test_checkDiagonalWin_win_diag1_start_middle

	0	1	2	3	4
0					
1				x	
2			x		
3		x			
4					

boolean checkDiagonalWin(BoardPosition lastPos, char player)

Input:	Output:	Reason:
State: (win_req = 3) lastPos.getRow = 1 lastPos.getCol = 1 Player = x	Output: true State: unchanged	This test case is unique and distinct because lastPos is the upper-leftmost marker in the winning diagonal; therefore, it will have to check markers to the lower-right of lastPos. Function name: test_checkDiagonalWin_win_start_upper_left

	0	1	2	3	4
0					
1		x			
2			x		
3				x	
4					

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boolean checkDiagonalWin(BoardPosition lastPos, char player)

Input:	Output:	Reason:
State: (win_req = 3) lastPos.getRow = 3 lastPos.getCol = 3 Player = x	Output: true State: unchanged	This test case is unique and distinct because lastPos is the lower-rightmost marker in the winning diagonal; therefore, it will have to check markers to the upper-left of lastPos. Function name: test_checkDiagonalWin_win_start_lower_right

	0	1	2	3	4
0					
1		x			
2			x		
3				x	
4					

boolean checkDiagonalWin(BoardPosition lastPos, char player)

Input:	Output:	Reason:
State: (win_req = 3) lastPos.getRow = 2 lastPos.getCol = 2 Player = x	Output: true State: unchanged	This test case is unique and distinct because lastPos is the lower-rightmost marker in the winning diagonal; therefore, it will have to check markers to the upper-left and lower-right of lastPos. Function name: test_checkDiagonalWin_win_diag2_start_middle

	0	1	2	3	4
0					
1		x			
2			x		
3				x	
4					

boolean checkDiagonalWin(BoardPosition lastPos, char player)

Input:	Output:	Reason:
State: (win_req = 3) lastPos.getRow = 1 lastPos.getCol = 1 Player = x	Output: false State: unchanged	This test case is unique and distinct because there is a marker of another player interrupting the diagonal of markers being checked; therefore, there is not a win. Function name: test_checkDiagonalWin_no_win_interrupt

	0	1	2	3	4
0					
1		x			
2			y		
3				x	
4					

checkForDraw Tests

boolean checkForDraw()

Input:	Output:	Reason:
State:	Output: false State: unchanged	This test case is unique because it tests checkForDraw on an NxN gameboard for which a draw has not occurred. Function name: test_checkForDraw_no_draw_NxN

	0	1	2	3	4
0	x	x	x	x	x
1	x	x	x	x	x
2	x	x	x	x	x
3	x	x	x	x	x
4	x	x	x	x	

boolean checkForDraw()

Input:	Output:	Reason:
State:	Output: true State: unchanged	This test case is unique because it tests checkForDraw on an NxN gameboard for which a draw has occurred. Function name: test_checkForDraw_draw_NxN

	0	1	2	3	4
0	x	x	x	x	x
1	x	x	x	x	x
2	x	x	x	x	x
3	x	x	x	x	x
4	x	x	x	x	x

boolean checkForDraw()

Input: State:	Output: false State: unchanged	Reason: This test case is unique because it tests checkForDraw on an NxM (N != M) gameboard for which a draw has not occurred. Function name: test_checkForDraw_no_draw_NxM

	0	1	2	3	4	5
0	x	x	x	x	x	x
1	x	x	x	x	x	x
2	x	x	x	x	x	x
3	x	x	x	x	x	x
4	x	x	x	x	x	

boolean checkForDraw()

Input: State:	Output: true State: unchanged	Reason: This test case is unique because it tests checkForDraw on an NxM (N != M) gameboard for which a draw has occurred. Function name: test_checkForDraw_draw_NxM

	0	1	2	3	4	5
0	x	x	x	x	x	x
1	x	x	x	x	x	x
2	x	x	x	x	x	x
3	x	x	x	x	x	x
4	x	x	x	x	x	x

whatsAtPos Tests

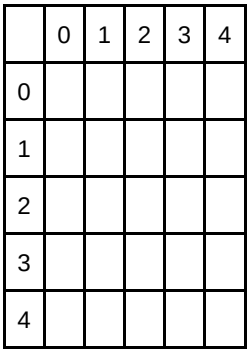
char whatsAtPos(BoardPosition pos)

Input: State:	Output: x State: unchanged	Reason: This test case is unique because it tests whatsAtPos on a valid position on the board; it checks to make sure that it returns the value at pos. Function name: test_whatsAtPos_x_on_board

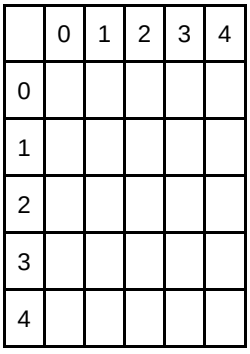
	0	1	2	3	4
0					
1					
2			x		
3					
4					

pos.getRow = 2
pos.getCol = 2

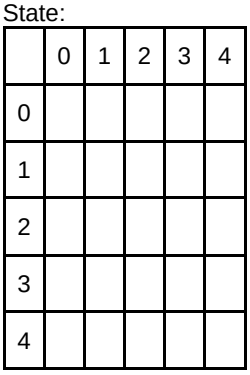
char whatsAtPos(BoardPosition pos)

Input: State:  pos.getRow = 0 pos.getCol = 5	Output: ~ State: unchanged	Reason: This test case is unique because it tests whatsAtPos on a invalid position that is out of bounds. The spot being checked is beyond the right boundary of the board. Function name: test_whatsAtPos_tilde_off_board_right

char whatsAtPos(BoardPosition pos)

Input: State:  pos.getRow = 0 pos.getCol = -1	Output: ~ State: unchanged	Reason: This test case is unique because it tests whatsAtPos on a invalid position that is out of bounds. The spot being checked is beyond the left boundary of the board. Function name: test_whatsAtPos_tilde_off_board_left

char whatsAtPos(BoardPosition pos)

Input: State:  pos.getRow = 5 pos.getCol = 0	Output: ~ State: unchanged	Reason: This test case is unique because it tests whatsAtPos on a invalid position that is out of bounds. The spot being checked is beyond the bottom boundary of the board. Function name: test_whatsAtPos_tilde_off_board_bottom

char whatsAtPos(BoardPosition pos)

Input: State: (0–4 × 0–4, all empty) pos.getRow = -1 pos.getCol = 0	Output: ~ State: unchanged	Reason: This test case is unique because it tests whatsAtPos on a invalid position that is out of bounds. The spot being checked is beyond the upper boundary of the board. Function name: test_whatsAtPos_tilde_off_board_top

isPlayerAtPos Tests

char isPlayerAtPos(BoardPosition pos, char player)

Input: State: (0–4 × 0–4, x at row 2, col 2) pos.getRow = 2 pos.getCol = 2 player = x	Output: true State: unchanged	Reason: This test case is unique because it tests isPlayerAtPos on a valid position on the board with player at the position. Function name: test_isPlayerAtPos_yes

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char isPlayerAtPos(BoardPosition pos, char player)

Input: State: pos.getRow = 2 pos.getCol = 2 player = x	Output: false State: unchanged	Reason: This test case is unique because it tests isPlayerAtPos on a valid position on the board with a different player at the position. Function name: test_isPlayerAtPos_no_different_player

	0	1	2	3	4
0					
1					
2			y		
3					
4					

char isPlayerAtPos(BoardPosition pos, char player)

Input: State: pos.getRow = 2 pos.getCol = 2 player = x	Output: false State: unchanged	Reason: This test case is unique because it tests isPlayerAtPos on a valid position on the board with no player at the position. Function name: test_isPlayerAtPos_no_empty

	0	1	2	3	4
0					
1					
2					
3					
4					

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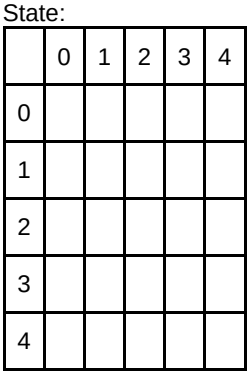
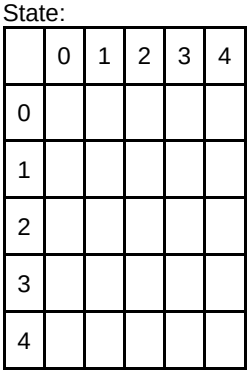
char isPlayerAtPos(BoardPosition pos, char player)

Input: State:  pos.getRow = 2 pos.getCol = 5 player = x	Output: false State: unchanged	Reason: This test case is unique because it tests isPlayerAtPos on an invalid position (invalid column) Function name: test_isPlayerAtPos_no_invalid_column

char isPlayerAtPos(BoardPosition pos, char player)

Input: State:  pos.getRow = 5 pos.getCol = 2 player = x	Output: false State: unchanged	Reason: This test case is unique because it tests isPlayerAtPos on an invalid position (invalid row) Function name: test_isPlayerAtPos_no_invalid_row

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placeMarker Tests

void placeMarker(BoardPosition pos, char player)

Input:
State:

	0	1	2	3	4
0					
1					
2					
3					
4					

pos.getRow = 2
pos.getCol = 2
player = x

Output:
State:

	0	1	2	3	4
0					
1					
2			x		
3					
4					

Reason:
This test case is unique because it tests placeMarker on an empty position on the board.

Function name:
test_placeMarker_x_valid_position

void placeMarker(BoardPosition pos, char player)

Input:
State:

	0	1	2	3	4
0					
1					
2			y		
3					
4					

pos.getRow = 2
pos.getCol = 2
player = x

Output:
State:

	0	1	2	3	4
0					
1					
2			y		
3					
4					

Reason:
This test case is unique because it tests placeMarker on a space occupied by another player the board.

Function name:
test_placeMarker_x_occupied_different

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void placeMarker(BoardPosition pos, char player)

Input:
State:

	0	1	2	3	4
0					
1					
2			x		
3					
4					

pos.getRow = 2
pos.getCol = 2
player = x

Output:
State:

	0	1	2	3	4
0					
1					
2			x		
3					
4					

Reason:
This test case is unique because it tests placeMarker on a space occupied by the same player the board.

Function name:
test_placeMarker_x_occupied_same

void placeMarker(BoardPosition pos, char player)

Input:
State:

	0	1	2	3	4
0					
1					
2					
3					
4					

pos.getRow = 0
pos.getCol = 5
player = x

Output:
State:

	0	1	2	3	4
0					
1					
2					
3					
4					

Reason:
This test case is unique because it tests placeMarker on a position with a column that is out of bounds.

Function name:
test_placeMarker_x_out_of_bounds_col

void placeMarker(BoardPosition pos, char player)

Input:
State:

	0	1	2	3	4
0					
1					
2					
3					
4					

pos.getRow = 5
pos.getCol = 0
player = x

Output:
State:

	0	1	2	3	4
0					
1					
2					
3					
4					

Reason:
This test case is unique because it tests placeMarker on a position with a row that is out of bounds.

Function name:
test_placeMarker_x_out_of_bounds_row

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GameScreen
-players:list<Character>[MIN_PLAYERS..MAX_PLAYERS] -currentPlayer: Character[1] {must be a member of players} -board: GameBoard[1] +MAX_PLAYERS:int[1] = 10 +MIN_PLAYERS:int[1] = 2
+main(): void -nextPlayer(): void -makePlay(): boolean

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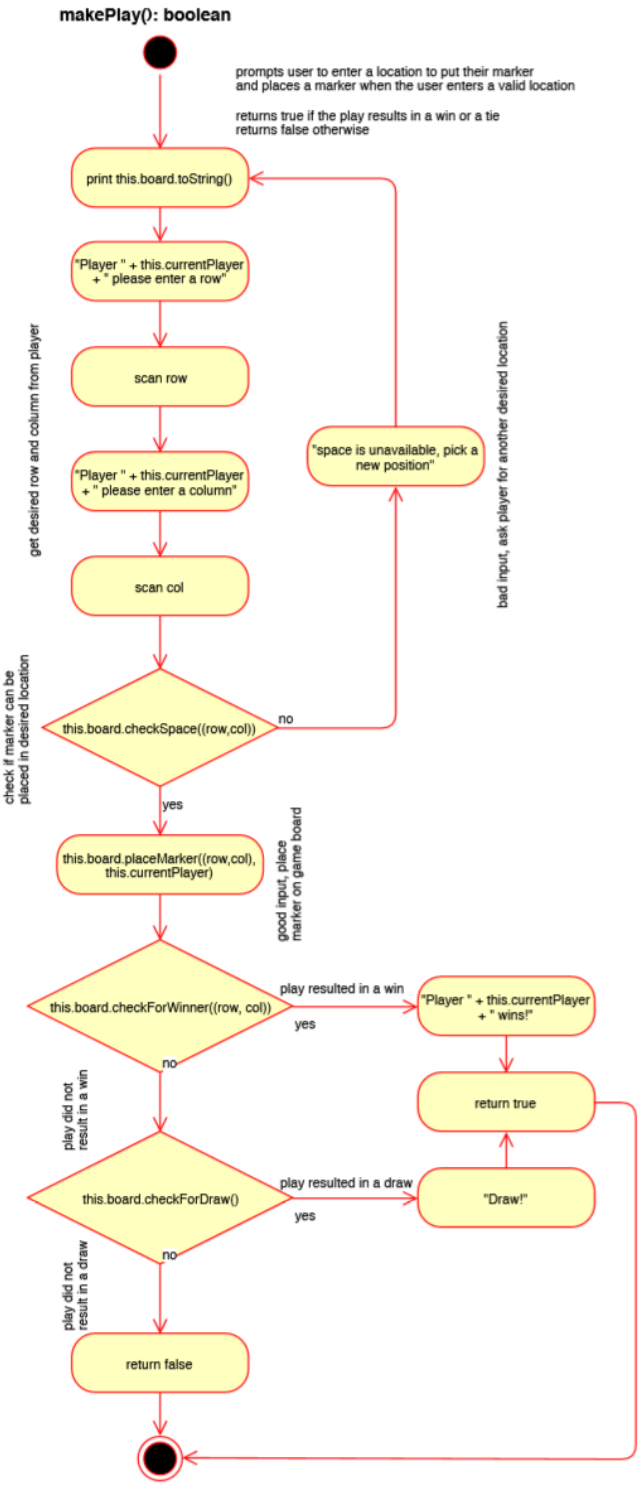

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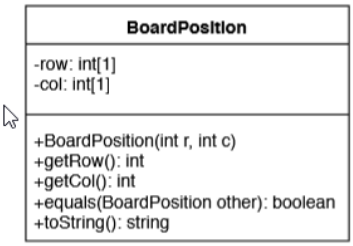

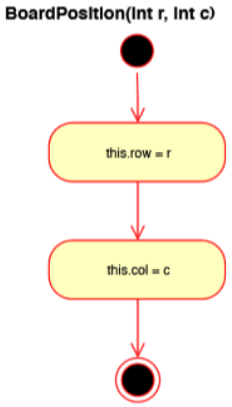

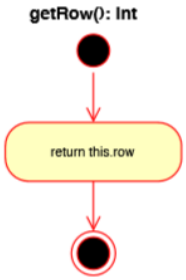

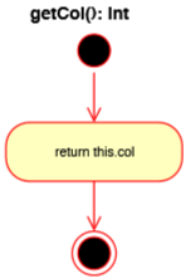

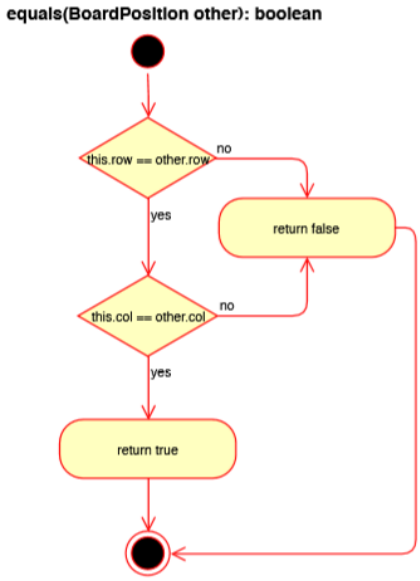

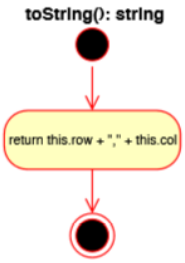

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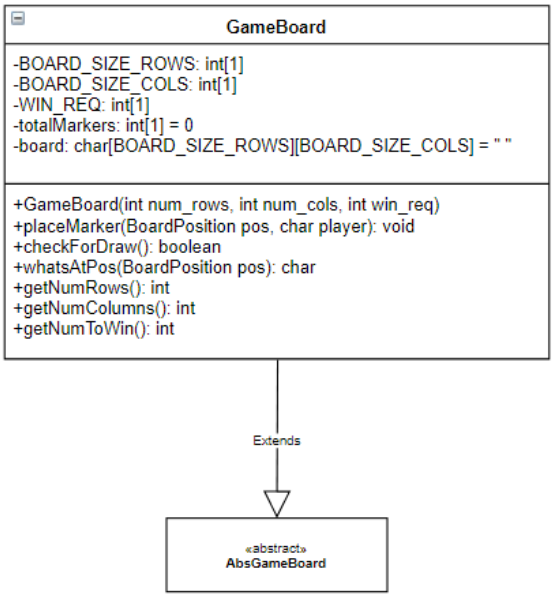

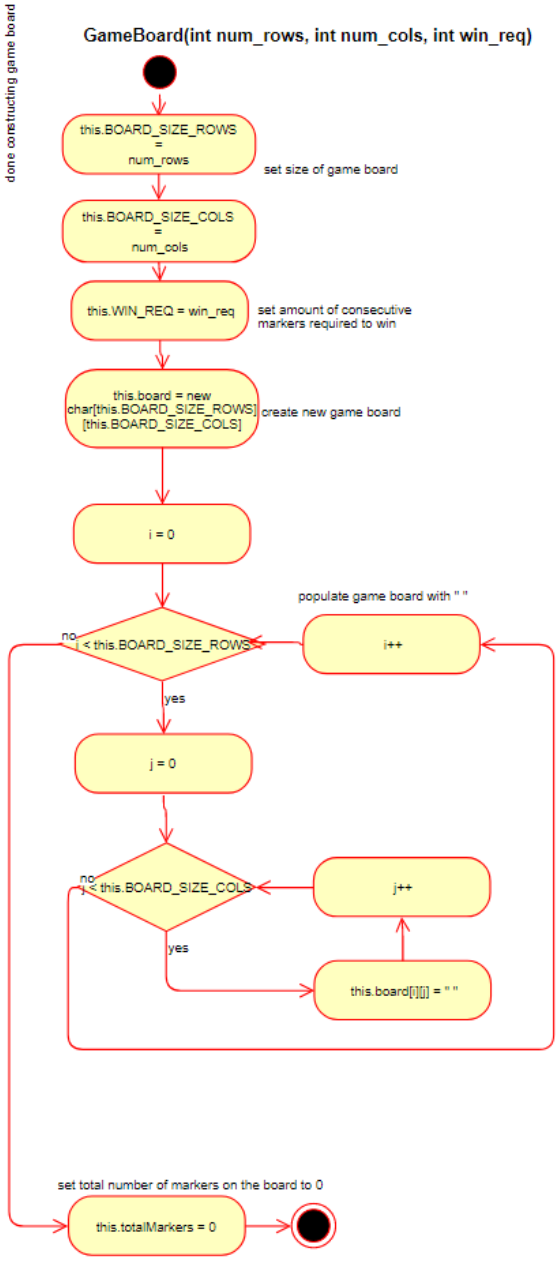

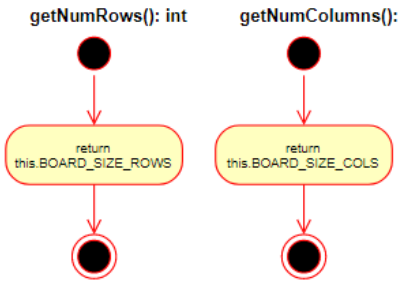

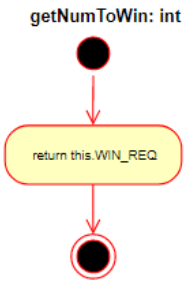

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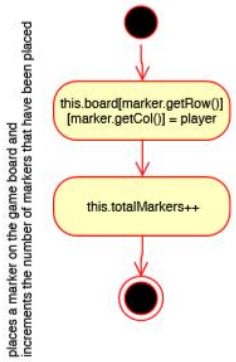
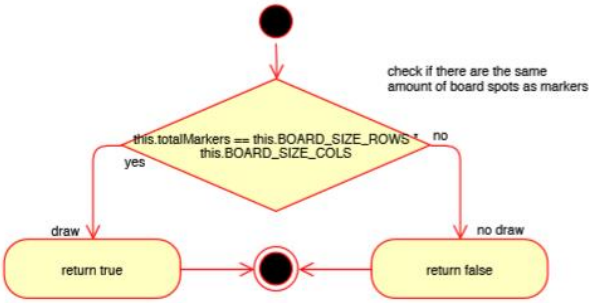
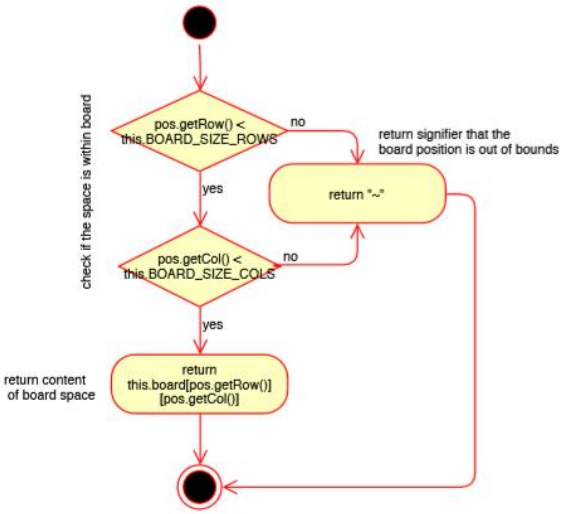
placeMarker(BoardPosition marker, char player): void



checkForDraw(): boolean



whatsAtPos(BoardPosition pos): char



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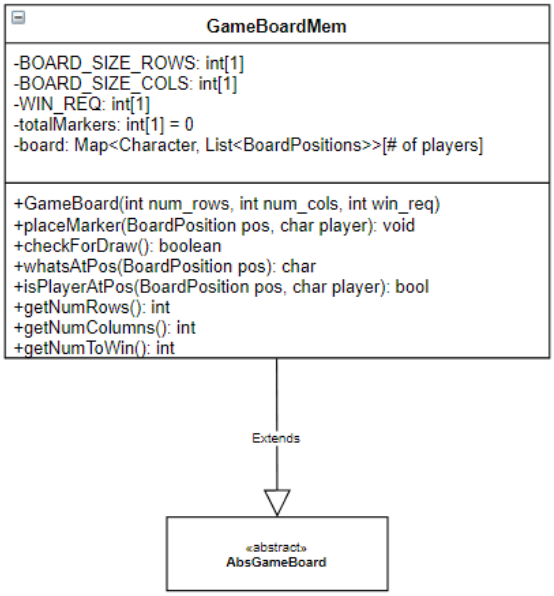

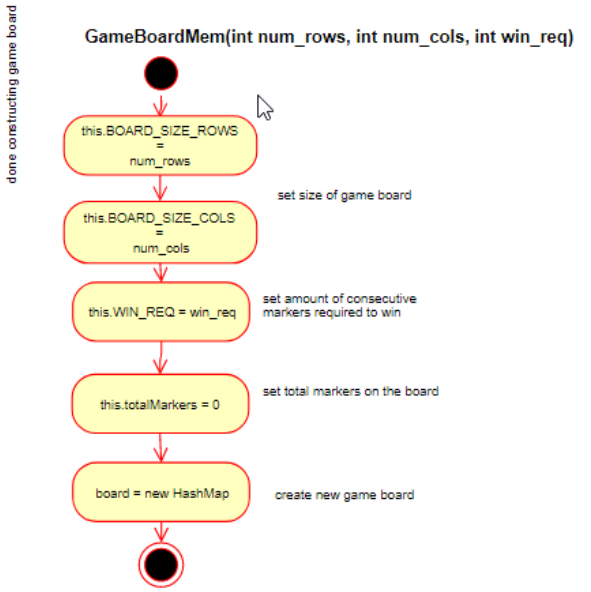

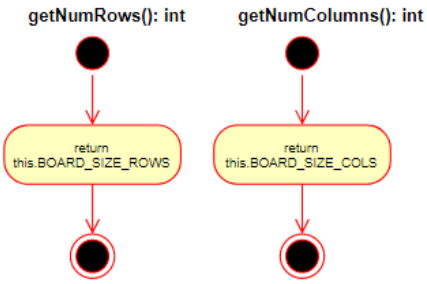

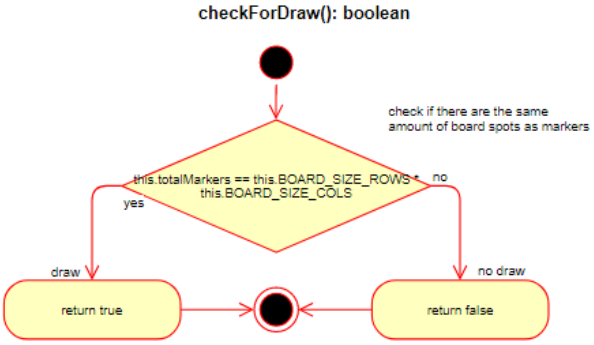

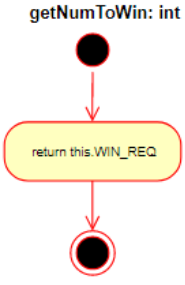

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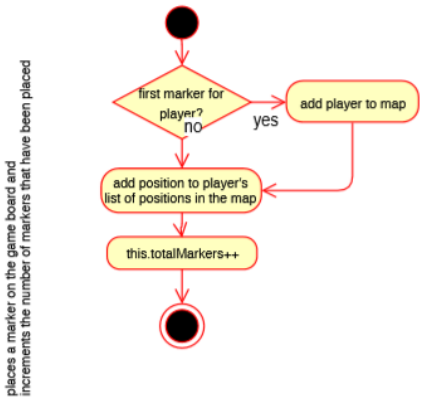
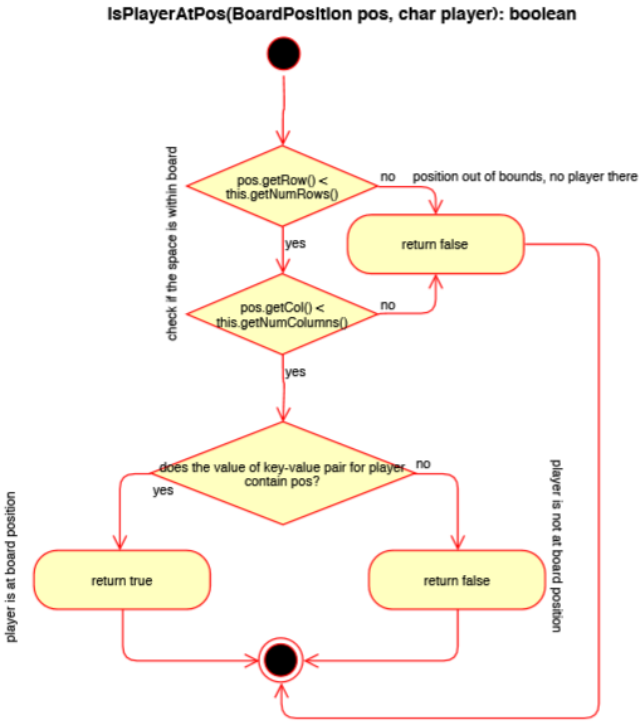
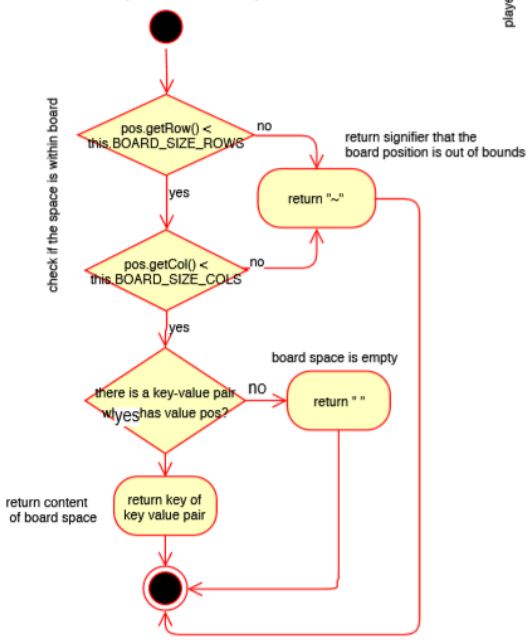
placeMarker(BoardPosition marker, char player): void



isPlayerAtPos(BoardPosition pos, char player): boolean



whatsAtPos(BoardPosition pos): char



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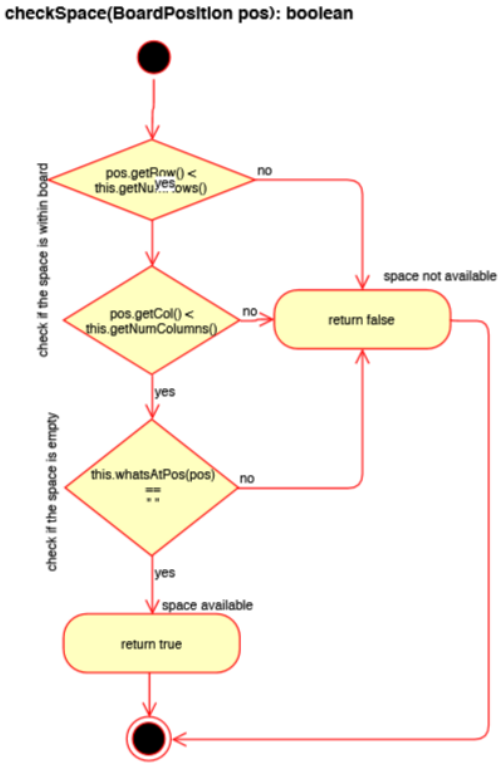

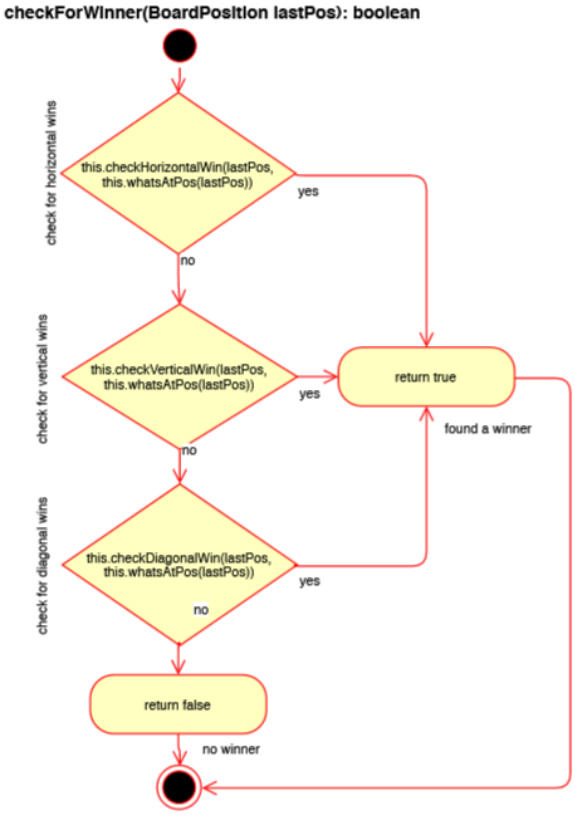

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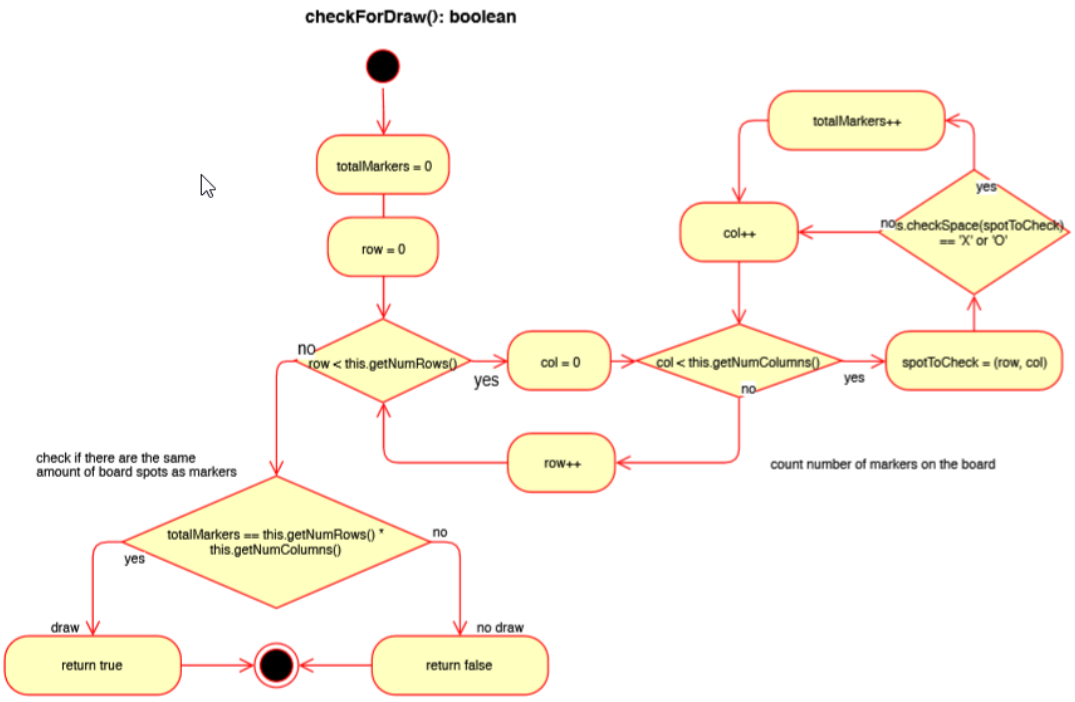

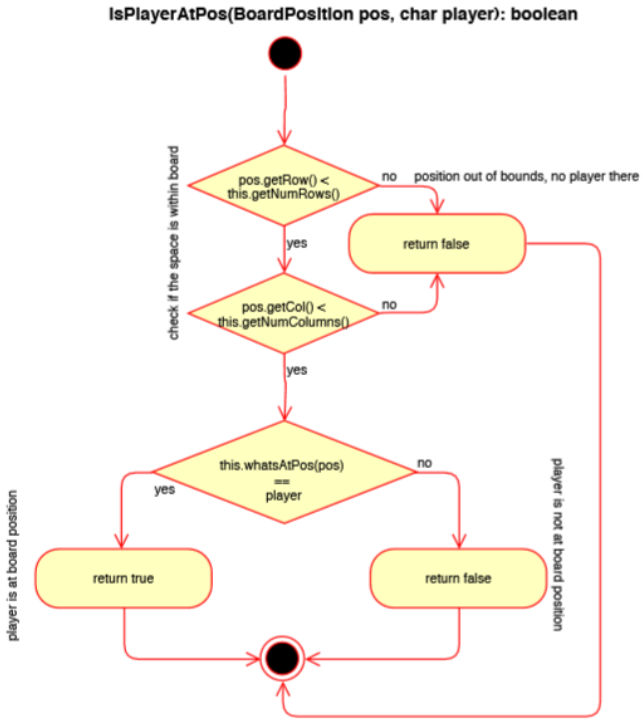

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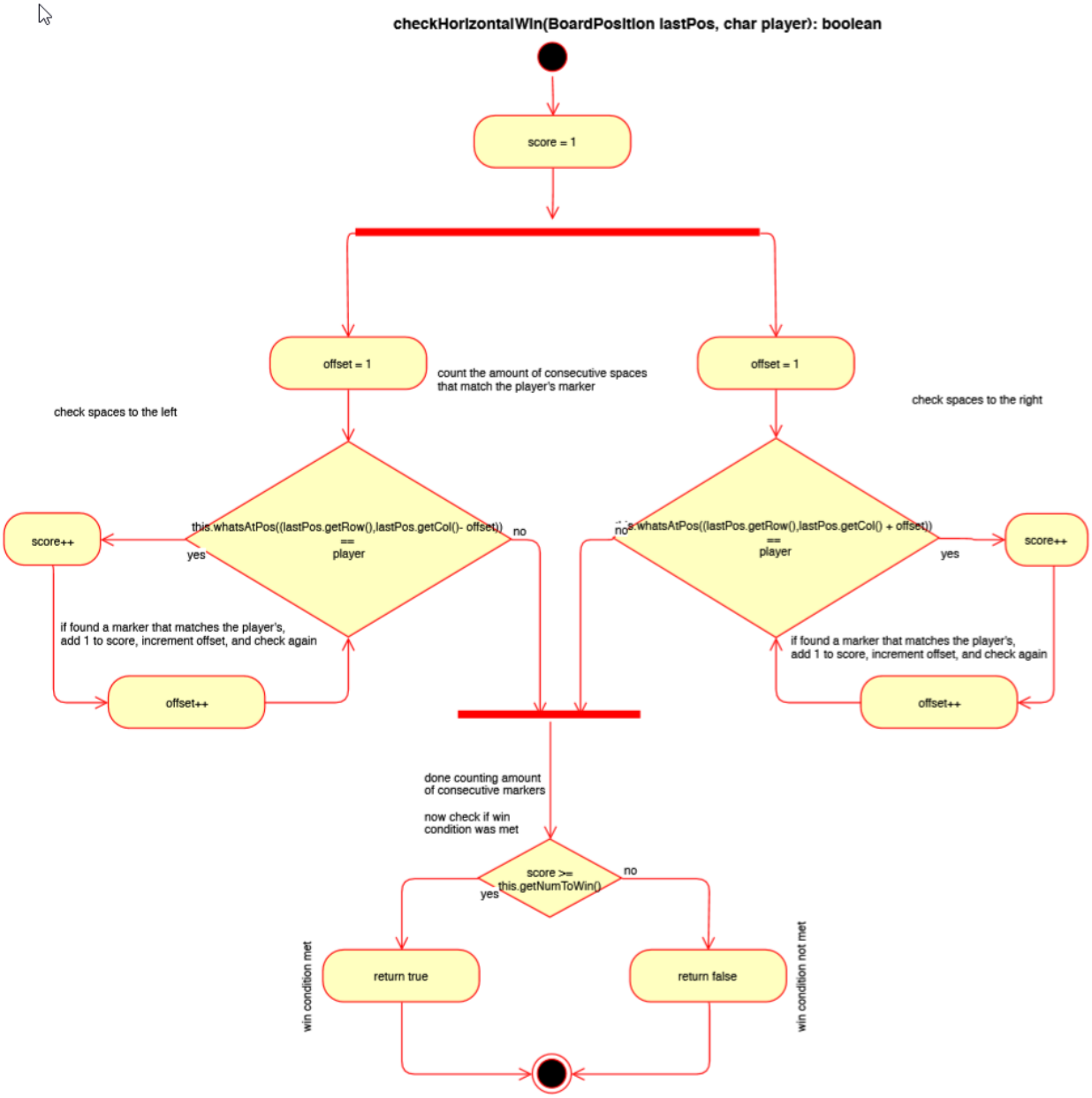

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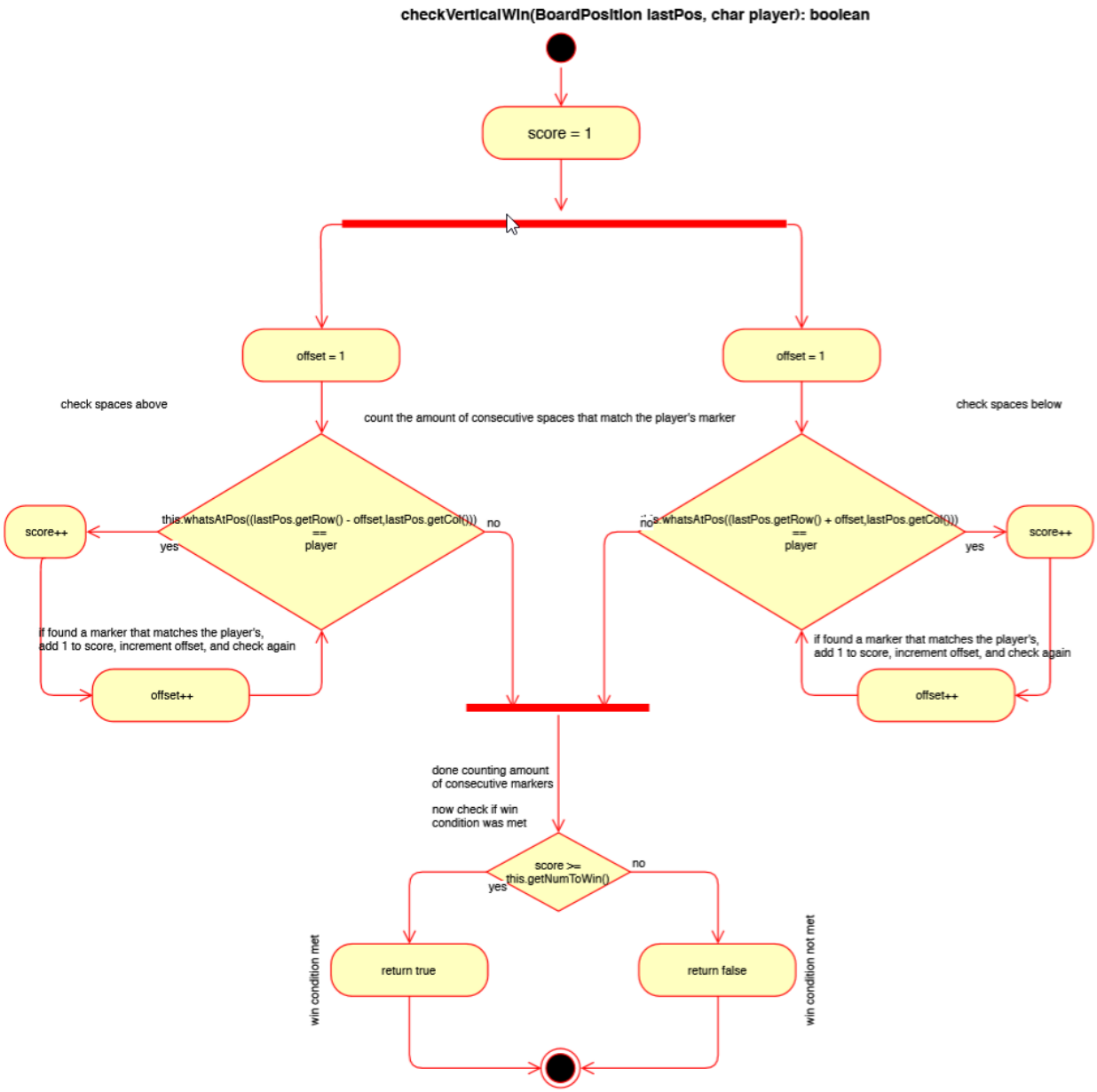

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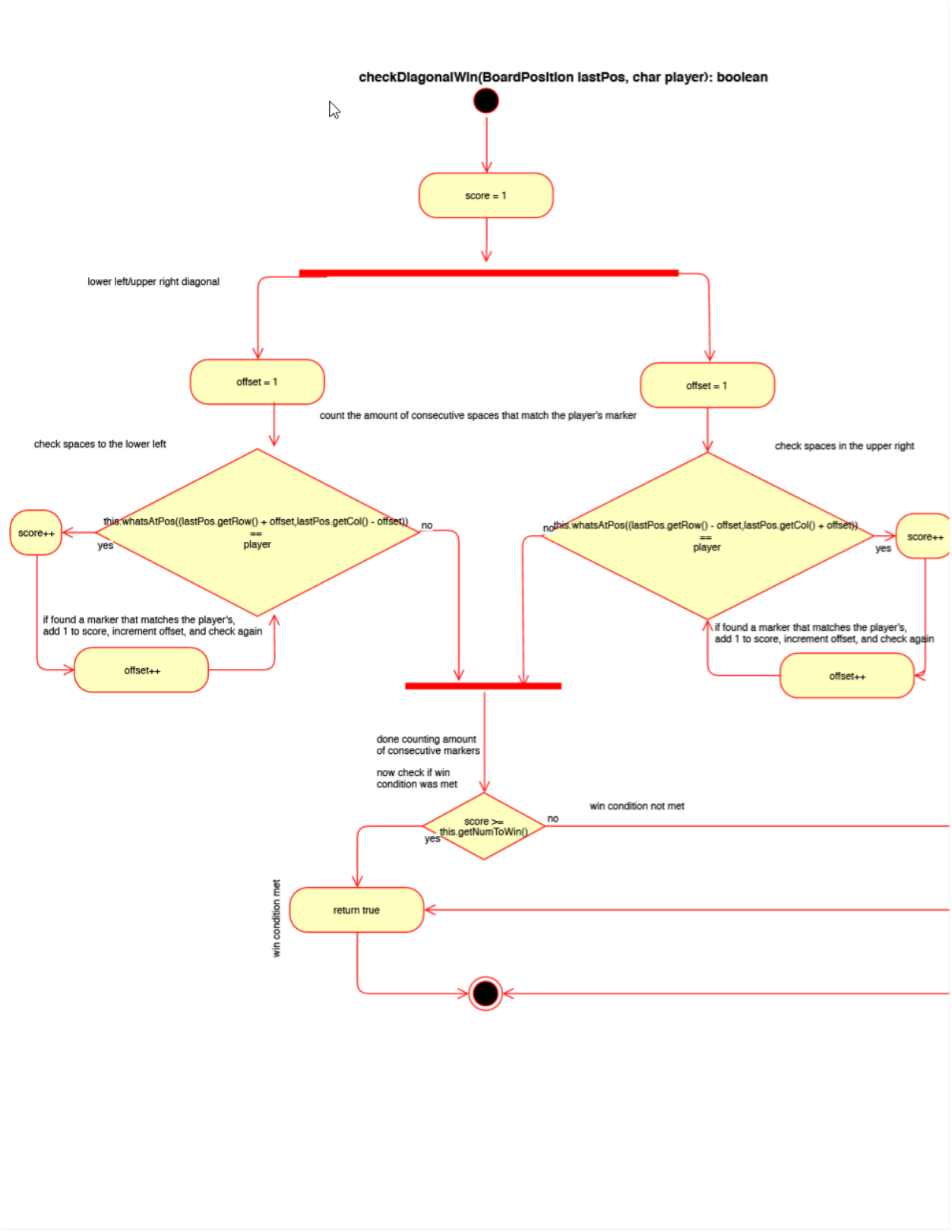

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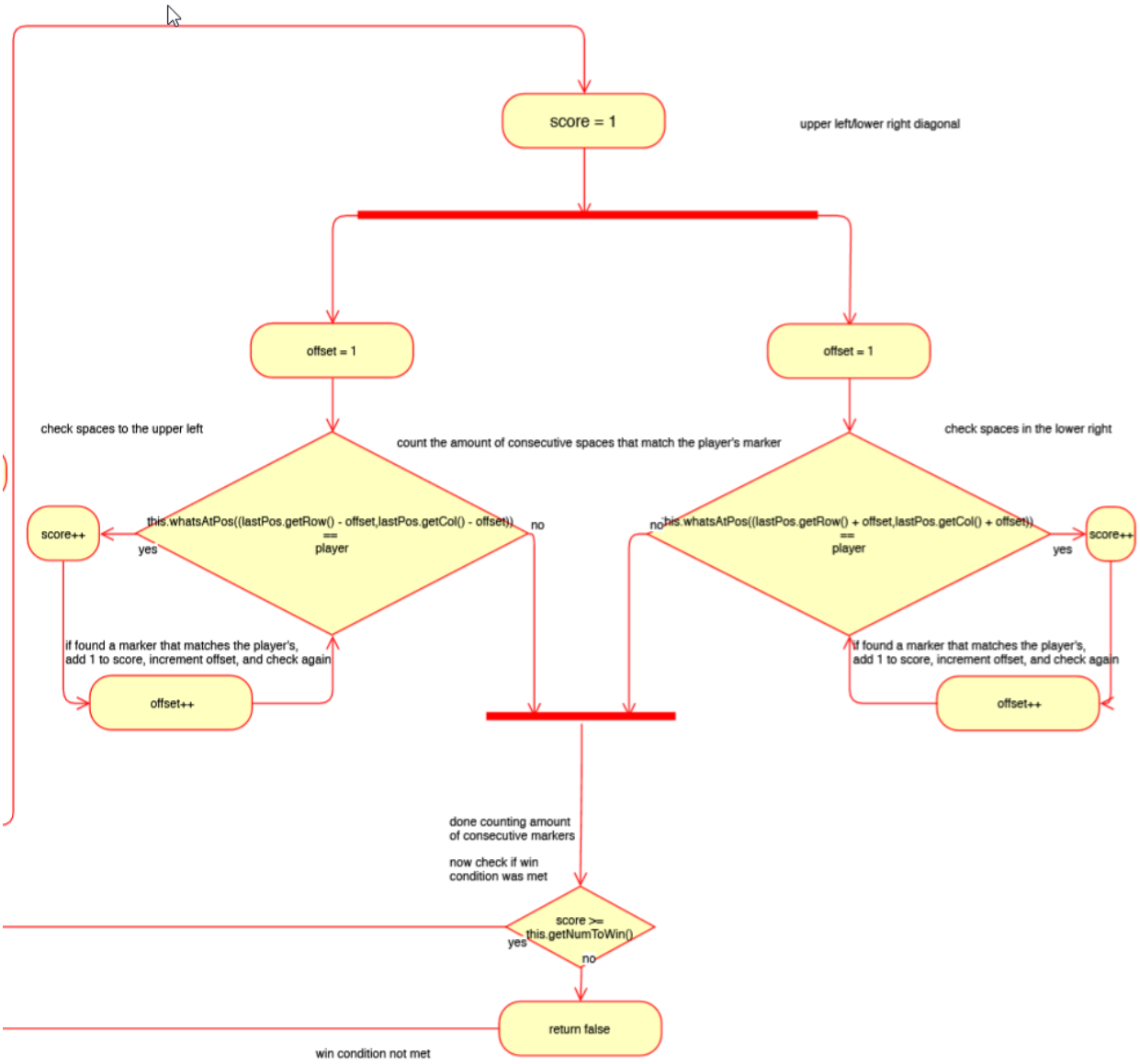

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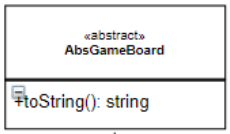

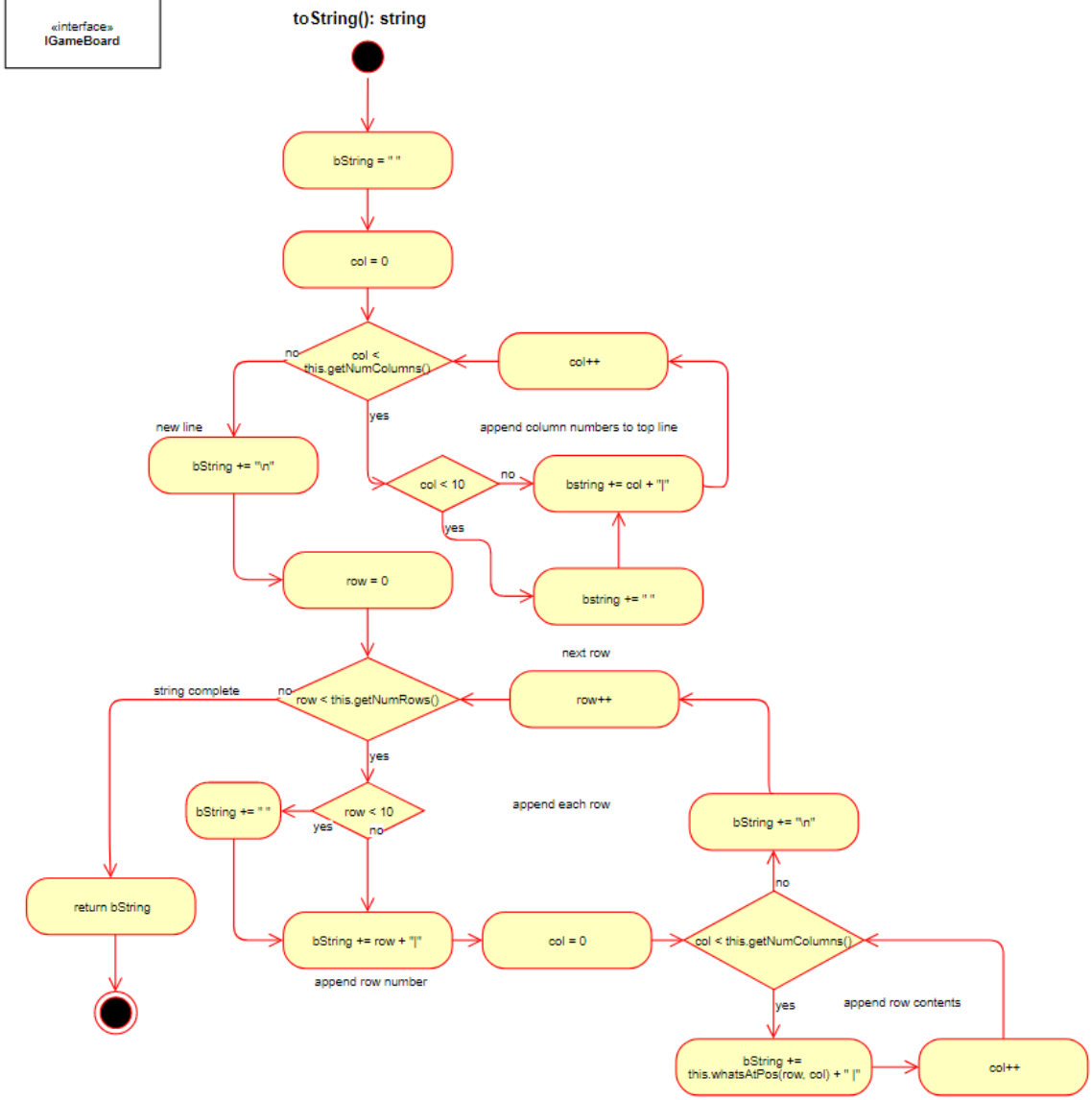

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TicTacToeController
-MAX_PLAYERS: int[1] = 10 -MIN_PLAYERS: int[1] = 2 -screen: TicTacToeView[1] -players: List<Character>[MIN_PLAYERS...MAX_PLAYERS] -currentPlayer: Character[1] -curGame: IGameBoard[1] -gameOver: boolean[1] = false
+TicTacToeController() +processButtonClick(int row, int col): void -newGame():void

processButtonClick(int row, int col): void