

ConnectFive! – Programmer's Manual

1. Introduction

1.1 - Scope

ConnectFive! is a two-player computer game similar to Tic-Tac-Toe or Connect 4, but on a larger scale. Each player drops colored tokens into a 6x7 grid, attempting to get five tokens of their color in a row. The first player to get five tokens in a row wins the game.

a. Platform

ConnectFive! will be installable on computers running the Windows 7 operating system.

b. Application Type

The game will run as a stand-alone application on the host computer. It does not require network or Internet accessibility. It is based on the Java platform. The application will be packaged as a stand-alone executable with a self-contained Java Runtime Environment. It will run in a dedicated window.

c. Interfaces

No other programming interfaces are necessary for the application to run.

d. Technology

ConnectFive! will be built using the Java programming language and virtual machine. Application logic will be edited and compiled using the Eclipse or NetBeans IDE. The user interface will be developed using JavaFX through the JavaFX Scene Builder. The interface will be graphical, utilizing push buttons and selection menus for game decisions and selections. Development will occur on both Windows 7 and Mac OSX based machines.

e. Structure

Game play will take place between two human players or a human player against the computer. Algorithms will be designed to replicate intelligence for the computer player. Upon starting the application, an initial game type selection menu will be shown allowing for a selection of player vs. player, computer vs. player, or exit. Depending on the selection, the game board will be displayed and the first user will be selected at random. Each player takes a turn in sequence until a winner or a tie is achieved. At this point, a selection to play again or return to the menu is given. If play again is selected, game play resumes between the two previous players. If return to menu is selected, the initial game type selection is displayed.

1.2 – References

a. Original “Connect Four” game instructions were used for reference. (*Hasbro - <http://www.hasbro.com/common/documents/dad2614d1c4311ddb0b0800200c9a66/1EF6874419B9F36910222EB9858E8CB8.pdf>*)

2. General Description

2.1 – Product Perspective

This software is being built as a semester project for Roger West’s University of Illinois – Springfield CSC 478 Software Engineering Capstone class. Aside from the educational aspects tied to the development, the end product is meant merely for fun.

2.2 – Product Function

The software is similar to the game “Connect Four” only we will be requiring 5 consecutive user-held slots (horizontally, vertically, or diagonally) to win, instead of 4. The game supports two players (either player vs. player or player vs. computer) with each person taking a turn until either there is a winner or there are no more available slots to play.

2.3 – User Characteristics

Anyone who liked the old Connect Four game and would like to play a more modern, digital version of the old favorite.

2.4 – General Constraints

The game does not currently work over a network connection; therefore, players must be at the same machine. The software does not keep track of each player's number of wins or losses.

2.5 – Assumptions and Dependencies

ConnectFive! will be installable on computers running the Windows 7 operating system with the most recent version of Java installed.

3. Specific Requirements

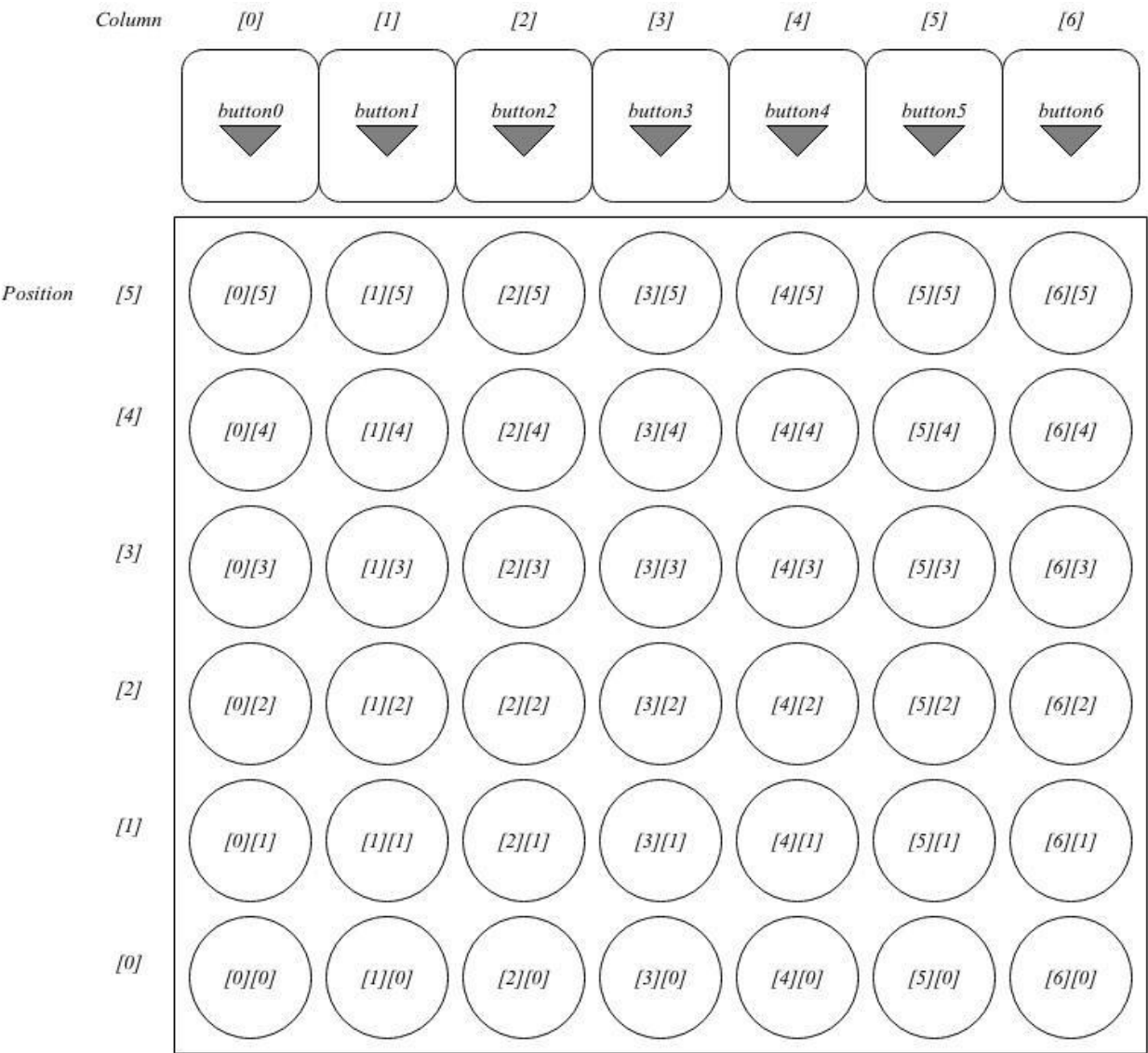
User Interface

- 1.0 – User should be able to choose which type of game to play
 - 1.1 - The game should allow user to play versus another human player
 - 1.2 - The game should allow user to play against a computer player
 - 1.3 - The game should allow the user to exit
- 2.0 – Display submenu
 - 2.1 – End Game option
 - 2.2 – New Game option
 - 2.3 – Exit Game option
- 3.0 – Display empty game board
- 4.0 – Setup click event handlers for turn-taking
- 5.0 – Start Game
- 6.0 – Take a turn (Human Player – handled by click events)
 - 6.1 – Hide opposing player's colored arrows if visible
 - 6.2 - Display current player's arrows above columns
 - 6.2.1 – Computer Player: Call ComputerPlayer class' method for deciding move
 - 6.2.1.1 – Scan the board vertically
 - 6.2.1.2 – Scan the board laterally
 - 6.2.1.3 – Scan the board diagonally
 - 6.2.1.4 – If move not set, get random coordinates
 - 6.2.1.5 – Return column to play
 - 6.3 - Drop current player's colored token image in chosen column and add token to array of game board token

6.4 - Process the move

- 6.4.1 – Call Gameboard method checkWinner
 - 6.4.1.1 – Scan board laterally
 - 6.4.1.2 – Scan board vertically
 - 6.4.1.3 – Scan board diagonally
- 6.4.2 If it's a winning move, clear player labels, arrows, and show correct winner label.
 - 6.4.2.1 Show new game button
- 6.4.3 If it's a move that causes a draw game, clear player labels, arrows, and show draw game label.
- 6.4.4 If not a winning move, switch current player and show new current player's arrows.

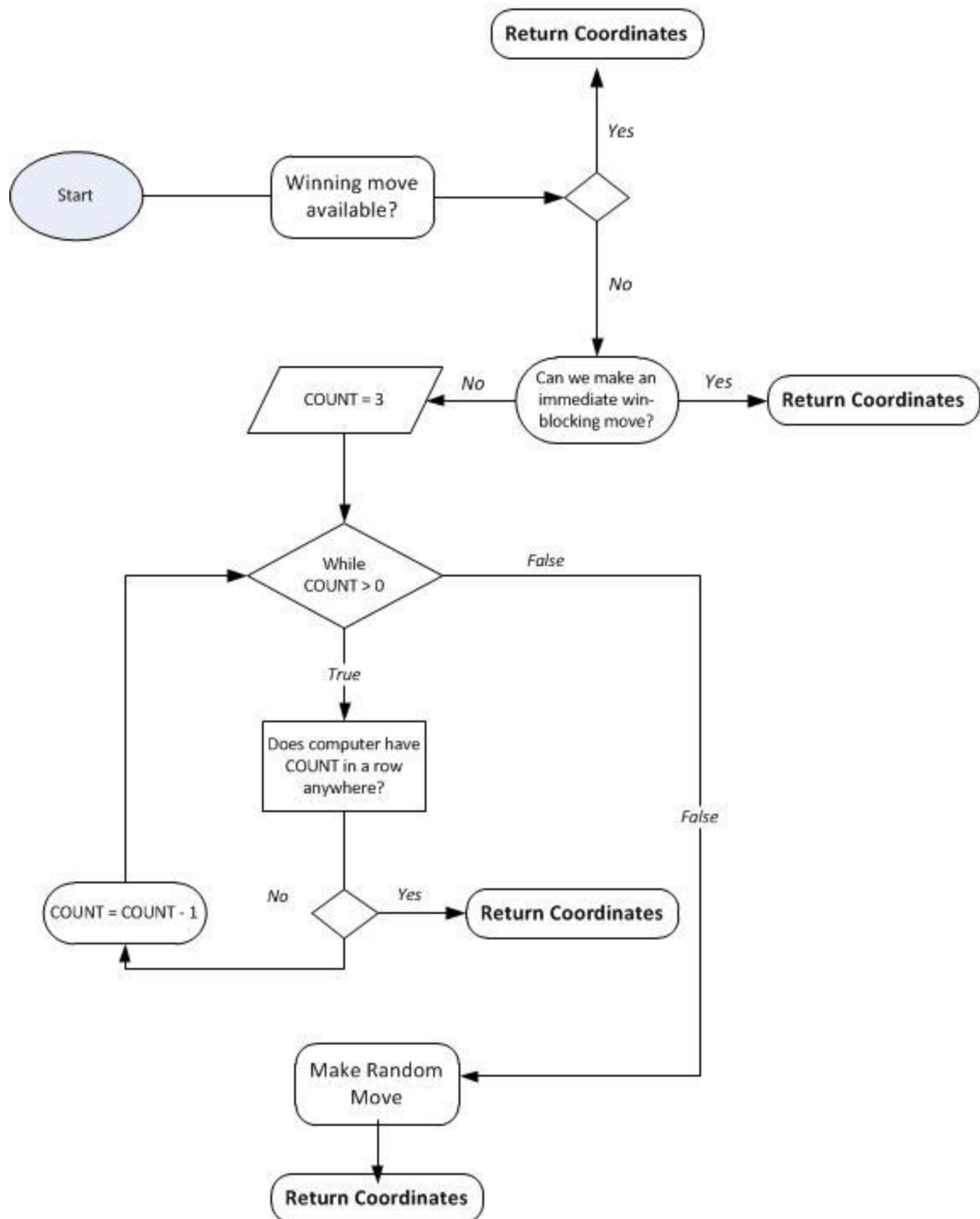
Gameboard Layout



Gameboard Layout Values

<i>Start</i>		<i>(192, 13)</i>	<i>(282, 13)</i>	<i>(372, 13)</i>	<i>(462, 13)</i>	<i>(552, 13)</i>	<i>(642, 13)</i>	<i>(732, 13)</i>
<i>Column</i>		<i>[0]</i>	<i>[1]</i>	<i>[2]</i>	<i>[3]</i>	<i>[4]</i>	<i>[5]</i>	<i>[6]</i>
<i>Position</i>	<i>[5]</i>	<i>Y + 100</i>	<i>Y + 100</i>	<i>[2][5]</i>	<i>[3][5]</i>	<i>[4][5]</i>	<i>[5][5]</i>	<i>[6][5]</i>
	<i>[4]</i>	<i>Y + 190</i>	<i>[1][4]</i>	<i>[2][4]</i>	<i>[3][4]</i>	<i>[4][4]</i>	<i>[5][4]</i>	<i>[6][4]</i>
	<i>[3]</i>	<i>Y + 280</i>	<i>[1][3]</i>	<i>[2][3]</i>	<i>[3][3]</i>	<i>[4][3]</i>	<i>[5][3]</i>	<i>[6][3]</i>
	<i>[2]</i>	<i>Y + 370</i>	<i>[1][2]</i>	<i>[2][2]</i>	<i>[3][2]</i>	<i>[4][2]</i>	<i>[5][2]</i>	<i>[6][2]</i>
	<i>[1]</i>	<i>Y + 460</i>	<i>[1][1]</i>	<i>[2][1]</i>	<i>[3][1]</i>	<i>[4][1]</i>	<i>[5][1]</i>	<i>[6][1]</i>
	<i>[0]</i>	<i>Y + 550</i>	<i>[1][0]</i>	<i>[2][0]</i>	<i>[3][0]</i>	<i>[4][0]</i>	<i>[5][0]</i>	<i>[6][0]</i>

Computer Player Logic



5. Testing Documentation

5.1 - Computer Player Testing

We’ll “seed” the board with human-occupied slots and see where the computer makes a play.

*** Red text = computer held position

Vertical Tests

Player Occupied	Where Computer Should Play	Pass/Fail
{0,0},{0,1},{0,2},{0,3}	{0,4}	Pass
{0,1},{0,2},{0,3},{0,4}	{0,5}	Pass
{0,2},{0,3},{0,4},{0,5}	Not in the 0 column	Pass
{0,0},{0,1},{0,2},{0,3}	Anywhere, but not a winner if in the 0 column	Pass
{0,0},{0,1},{0,2},{0,3},{1,0}	{1,1}	Pass
{0,0},{0,1},{0,2},{0,3},{1,0},{2,0}	{3,0}	Pass
{0,0},{0,1},{0,2},{0,3},{1,0},{2,0},{3,0}	{4,0}	Pass
{0,0},{0,1},{0,2},{0,3},{1,0},{2,0},{3,0},{4,0}	{5,0}/AND WIN	Pass/Pass
{3,0},{3,1},{3,2},{3,3}	{3,4}	Pass
{3,1},{3,2},{3,3},{3,4}	{3,5}	Pass
{3,2},{3,3},{3,4},{3,5}	Anywhere BUT column 4 (index 3)	Pass
{6,0},{6,1},{6,2},{6,3}	{6,4}	Pass
{6,1},{6,2},{6,3},{6,4}	{6,5}	Pass
{6,2},{6,3},{6,4},{6,5}	Anywhere but column 7 (index 6), as we’re at the top	Pass
{0,0},{0,1},{0,2},{0,3} {1,0},{1,1},{1,2},{1,3}	{1,4} /And WIN *If computer can make a move to win, that should take priority over a blocking move.	Pass/Pass
{0,0},{0,1},{0,2},{0,3} {1,0},{1,1},{1,2}	{0,4} – Here the blocking move should take priority	Pass
{0,0},{0,1},{0,2} {1,0},{1,1},{1,2}	{1,3} – Unless the human player has 4 consecutive chips, the computer should play to win.	Pass

Lateral Tests

Player Occupied	Where Computer Should Play	Pass/Fail
{0,0},{1,0},{2,0},{3,0}	{4,0}	Pass
{1,0},{2,0},{3,0},{4,0}	{5,0}	Pass
{2,0},{3,0},{4,0},{5,0}	{6,0}	Pass
{3,0},{4,0},{5,0},{6,0}	{2,0}	Pass
{1,5},{2,5},{3,5},{4,5},{5,4}	{5,5}	Pass
{1,5},{2,5},{3,5},{4,5},{5,3}	Anywhere but {5,4} *Playing {5,4} would allow the human player to make a winning move ({5,5}).	Pass
{1,5},{2,5},{3,5},{4,5},{5,2}	{5,3} *Assuming computer player doesn't have a winning move it can make.	Pass
{0,0},{1,0},{2,0},{3,0}	{4,0}/WIN	Pass/Pass
{0,2},{1,2},{2,2},{3,2}	Anywhere (assuming there is nothing in slot {4,1} which would provide a way to block)	Pass
{0,2},{1,2},{2,2},{3,2},{4,1}	{4,2} - Same as above but now there is a chip at {4,1} which would allow the computer to make a blocking move	Pass
{1,0},{2,1},{3,1},{4,1},{5,1}	{1,1}	Pass

Diagonal Tests

Player Occupied	Where Computer Should Play	Pass/Fail
{0,0},{1,1},{2,2},{3,3},{4,0},{4,1}	{4,2}	Pass
{0,0},{1,1},{2,2},{3,3},{4,0},{4,1},{4,2}	Anywhere BUT {4,3}. *Playing {4,3} would allow the human player to make a winning move at {4,4}	Pass (played {0,1})

5.2 Check Winner Testing

The game board is set up as a column-major, multidimensional array to represent a 7 x 6 grid (7 columns, 6 rows). Gameboard[column...0-6][row...0-5] .

*** **Red Text** indicates the opposition holds this spot.

*** I did not test for legal (in bounds) moves as the UI will handle this.

Lateral Tests for all rows

Array indices tested	Expected Result	Actual Result
{0,0},{1,0},{2,0},{3,0},{4,0}	Winner	Winner
{1,0},{2,0},{3,0},{4,0},{5,0}	Winner	Winner
{2,0},{3,0},{4,0},{5,0},{6,0}	Winner	Winner
{2,0},{3,0},{4,0},{5,0},{6,0}	Not a winner	Not a winner
{0,0},{1,0},{2,0},{3,0},{4,0}	Not a winner	Not a winner
{1,0},{2,0},{3,0},{4,0},{5,0}	Not a winner	Not a winner
{0,0},{1,0},{3,0},{4,0}	Not a winner	Not a winner
{1,0},{2,0},{3,0},{4,0}	Not a winner	Not a winner
{3,0},{4,0},{5,0},{6,0}	Not a winner	Not a winner
{0,1},{1,1},{2,1},{3,1},{4,1}	Winner	Winner
{1,1},{2,1},{3,1},{4,1},{5,1}	Winner	Winner
{2,1},{3,1},{4,1},{5,1},{6,1}	Winner	Winner
{0,1},{1,1},{2,1},{3,1},{4,1}	Not a winner	Not a winner
{1,1},{2,1},{3,1},{4,1},{5,1}	Not a winner	Not a winner
{2,1},{3,1},{4,1},{5,1},{6,1}	Not a winner	Not a winner
{0,2},{1,2},{2,2},{3,2},{4,2}	Winner	Winner
{1,2},{2,2},{3,2},{4,2},{5,2}	Winner	Winner
{2,2},{3,2},{4,2},{5,2},{6,2}	Winner	Winner
{0,2},{1,2},{2,2},{3,2},{4,2}	Not a winner	Not a winner
{1,2},{2,2},{3,2},{4,2},{5,2}	Not a winner	Not a winner
{2,2},{3,2},{4,2},{5,2},{6,2}	Not a winner	Not a winner
{0,3},{1,3},{2,3},{3,3},{4,3}	Winner	Winner
{1,3},{2,3},{3,3},{4,3},{5,3}	Winner	Winner
{2,3},{3,3},{4,3},{5,3},{6,3}	Winner	Winner
{0,4},{1,4},{2,4},{3,4},{4,4}	Winner	Winner
{1,4},{2,4},{3,4},{4,4},{5,4}	Winner	Winner
{2,4},{3,4},{4,4},{5,4},{6,4}	Winner	Winner
{0,5},{1,5},{2,5},{3,5},{4,5}	Winner	Winner
{1,5},{2,5},{3,5},{4,5},{5,5}	Winner	Winner
{2,5},{3,5},{4,5},{5,5},{6,5}	Winner	Winner
{0,5},{1,5},{2,5},{3,5}	Not a winner	Not a winner
{1,5},{2,5},{3,5},{4,5},{5,5}	Not a winner	Not a winner
{3,5},{4,5},{5,5},{6,5}	Not a winner	Not a winner

Vertical Tests

Array indices tested	Expected Result	Actual Result
{0,0},{0,1},{0,2},{0,3},{0,4}	Winner	Winner
{0,1},{0,2},{0,3},{0,4},{0,5}	Winner	Winner
{0,2},{0,3},{0,4},{0,5}	No winner	No Winner
{0,1},{0,2},{0,3},{0,4},{0,5}	No winner	No winner
{1,0},{1,1},{1,2},{1,3},{1,4}	Winner	Winner
{1,1},{1,2},{1,3},{1,4},{1,5}	Winner	Winner
{1,0},{1,1},{1,2},{1,3}	No winner	No winner
{1,1},{1,2},{1,3},{1,4}	No winner	No winner
{1,1},{1,2},{1,3},{1,4},{1,5}	No winner	No winner
{2,0},{2,1},{2,2},{2,3},{2,4}	Winner	Winner
{2,1},{2,2},{2,3},{2,4},{2,5}	Winner	Winner
{2,0},{2,1},{2,2},{2,3}	No winner	No winner
{2,2},{2,3},{2,4},{2,5}	No winner	No winner
{5,0},{5,1},{5,2},{5,3},{5,4}	Winner	Winner
{5,1},{5,2},{5,3},{5,4},{5,5}	Winner	Winner
{5,1},{5,2},{5,3},{5,4},{5,5}	No winner	No winner

Diagonal Tests

Check going forward		
{0,0},{1,1},{2,2},{3,3},{4,4}	Winner	Winner
{1,1},{2,2},{3,3},{4,4},{5,5}	Winner	Winner
{0,1},{1,2},{2,3},{3,4},{4,5}	Winner	Winner
{1,0},{2,1},{3,2},{4,3},{5,4}	Winner	Winner
{2,1},{3,2},{4,3},{5,4},{6,5}	Winner	Winner
{2,0},{3,1},{4,2},{5,3},{6,4}	Winner	Winner
{0,0},{1,1},{3,3},{4,4},{5,5}	No Winner	No winner
{0,0} , {1,1},{2,2},{3,3},{4,4}	No Winner	No winner
{1,1},{2,2},{3,3},{4,4},{ 5,5 }	No Winner	No winner
{0,1},{1,2},{ 2,3 },{3,4},{4,5}	No Winner	No winner
{1,0},{ 2,1 },{3,2},{4,3},{5,4}	No Winner	No winner
Check going backward		
{6,0},{5,1},{4,2},{3,3},{2,4}	Winner	Winner
{6,1},{5,2},{4,3},{3,4},{2,5}	Winner	Winner
{5,1},{4,2},{3,3},{2,4},{1,5}	Winner	Winner
{5,0},{4,1},{3,2},{2,3},{1,4}	Winner	Winner
{4,1},{3,2},{2,3},{1,4},{0,5}	Winner	Winner
{4,0},{3,1},{2,2},{1,3},{0,4}	Winner	Winner
{4,0},{3,1},{2,2},{1,3}	Not a winner	Not a winner
{4,0},{3,1},{2,2},{1,3},{ 0,4 }	Not a winner	Not a winner
{6,0} , {5,1},{4,2},{3,3},{2,4}	Not a winner	Not a winner

UI Testing

#	Test	Results	Pass	Fail
1	Display select game box on launch	Game selection box displayed	X	
2	Player vs. Player highlights on hover	Player vs. Player highlighted	X	
3	Player vs. Computer highlights on hover	Player vs. Computer highlighted	X	
4	Exit Game highlights on hover	Exit Game highlighted	X	
5	Player vs. Player game starts on button click	PvP game starts	X	
6	Player vs. Computer game starts on button click	PvC game starts	X	
7	Confirm exit box displayed on exit game button click	Confirm exit box appears	X	
8	Yes button on confirm exit box highlights on hover	Yes highlighted	X	
9	No button on confirm exit box highlights on hover	No highlighted	X	
10	Game exits on confirm exit box yes click	Game exits	X	
11	Select game box displayed on confirm exit box no click	Select game box displayed	X	
12	PvP game window (PvP GW) displays all widgets on launch	All widgets displayed	X	
13	PvP GW end game button highlights on hover	End game highlighted	X	
14	PvP GW exit button highlights on hover	Exit highlighted	X	
15	PvP GW current player displays current player	Current player displayed	X	
16	PvP GW current player color matches color of drop buttons	Current player: blue, buttons: blue	X	
17	PvP GW column 1 drop button highlights on hover	Column 1 button highlighted	X	
18	PvP GW column 2 drop button highlights on hover	Column 2 button highlighted	X	
19	PvP GW column 3 drop button highlights on hover	Column 3 button highlighted	X	
20	PvP GW column 4 drop button highlights on hover	Column 4 button highlighted	X	
21	PvP GW column 5 drop button highlights on hover	Column 5 button highlighted	X	
22	PvP GW column 6 drop button highlights on hover	Column 6 button highlighted	X	
23	PvP GW column 7 drop button highlights on hover	Column 7 button highlighted	X	
24	PvP GW confirm end game box displays on end game button click	Confirm end game box displayed	X	
25	PvP GW game ends on confirm end game box yes button click	PvP game ends	X	
26	PvP GW gameboard cleared on confirm end game box yes button click	Gameboard cleared	X	
27	PvP GW Select game box displayed on confirm end game yes button click	Select game box displayed	X	

28	PvP GW displayed with current game on confirm end game no button click	PvP GW displayed, current game	X	
29	PvP GW Confirm exit box displayed on exit button click	Confirm exit box appears	X	
30	PvP GW Game exits on confirm exit box yes click	Game exits	X	
31	PvP GW displayed with current game on confirm exit game no button click	PvP GW displayed, current game	X	
32	PvP GW column 1 drop button drops token matching button color	Matching colored token dropped	X	
33	PvP GW column 2 drop button drops token matching button color	Matching colored token dropped	X	
34	PvP GW column 3 drop button drops token matching button color	Matching colored token dropped	X	
35	PvP GW column 4 drop button drops token matching button color	Matching colored token dropped	X	
36	PvP GW column 5 drop button drops token matching button color	Matching colored token dropped	X	
37	PvP GW column 6 drop button drops token matching button color	Matching colored token dropped	X	
38	PvP GW column 7 drop button drops token matching button color	Matching colored token dropped	X	
39	PvP GW current player indicator changes on column 1 drop button click	Current player changes	X	
40	PvP GW current player indicator changes on column 2 drop button click	Current player changes	X	
41	PvP GW current player indicator changes on column 3 drop button click	Current player changes	X	
42	PvP GW current player indicator changes on column 4 drop button click	Current player changes	X	
43	PvP GW current player indicator changes on column 5 drop button click	Current player changes	X	
44	PvP GW current player indicator changes on column 6 drop button click	Current player changes	X	
45	PvP GW current player indicator changes on column 7 drop button click	Current player changes	X	
46	PvP GW token drops to lowest position open on column 1 drop button click	Token drops to lowest position open	X	
47	PvP GW token drops to lowest position open on column 2 drop button click	Token drops to lowest position open	X	
48	PvP GW token drops to lowest position open on column 3 drop button click	Token drops to lowest position open	X	
49	PvP GW token drops to lowest position open on column 4 drop button click	Token drops to lowest position open	X	
50	PvP GW token drops to lowest position open on column 5 drop button click	Token drops to lowest position open	X	
51	PvP GW token drops to lowest position open on column 6 drop button click	Token drops to lowest position open	X	
52	PvP GW token drops to lowest position open on column 7 drop button click	Token drops to lowest position open	X	
53	PvP GW column 1 drop button invisible when	Column 1 drop button invisible	X	

	column full			
54	PvP GW column 2 drop button invisible when column full	Column 2 drop button invisible	X	
55	PvP GW column 3 drop button invisible when column full	Column 3 drop button invisible	X	
56	PvP GW column 4 drop button invisible when column full	Column 4 drop button invisible	X	
57	PvP GW column 5 drop button invisible when column full	Column 5 drop button invisible	X	
58	PvP GW column 6 drop button invisible when column full	Column 6 drop button invisible	X	
59	PvP GW column 7 drop button invisible when column full	Column 7 drop button invisible	X	
60	PvP GW draw game displayed when all columns full and no winner	Draw game displayed	X	
61	PvP GW end game button changes to new game button on draw	New game button replaces end game button	X	
62	PvP GW select game box displayed on new game button click	Select game box displayed	X	
63	PvP GW gameboard cleared on new button click	Gameboard cleared	X	
64	PvP GW winning player displayed on win	Winning player displayed	X	
65	PvP GW end game button changes to new game button on win	New game button replaces end game button	X	
66	PvC game window (PvC GW) displays all widgets on launch	All widgets displayed	X	
67	PvC GW end game button highlights on hover	End game highlighted	X	
68	PvC GW exit button highlights on hover	Exit highlighted	X	
69	PvC GW current player displays current player	Current player displayed	X	
70	PvC GW current player color matches color of drop buttons	Current player: blue, buttons: blue	X	
71	PvC GW column 1 drop button highlights on hover	Column 1 button highlighted	X	
72	PvC GW column 2 drop button highlights on hover	Column 2 button highlighted	X	
73	PvC GW column 3 drop button highlights on hover	Column 3 button highlighted	X	
74	PvC GW column 4 drop button highlights on hover	Column 4 button highlighted	X	
75	PvC GW column 5 drop button highlights on hover	Column 5 button highlighted	X	
76	PvC GW column 6 drop button highlights on hover	Column 6 button highlighted	X	
77	PvC GW column 7 drop button highlights on hover	Column 7 button highlighted	X	
78	PvC GW confirm end game box displays on end game button click	Confirm end game box displayed	X	
79	PvC GW game ends on confirm end game box yes button click	PvC game ends	X	
80	PvC GW gameboard cleared on confirm end	Gameboard cleared	X	

	game box yes button click			
81	PvC GW Select game box displayed on confirm end game yes button click	Select game box displayed	X	
82	PvC GW displayed with current game on confirm end game no button click	PvC GW displayed, current game	X	
83	PvC GW Confirm exit box displayed on exit button click	Confirm exit box appears	X	
84	PvC GW Game exits on confirm exit box yes click	Game exits	X	
85	PvC GW displayed with current game on confirm exit game no button click	PvC GW displayed, current game	X	
86	PvC GW column 1 drop button drops token matching button color	Matching colored token dropped	X	
87	PvC GW column 2 drop button drops token matching button color	Matching colored token dropped	X	
88	PvC GW column 3 drop button drops token matching button color	Matching colored token dropped	X	
89	PvC GW column 4 drop button drops token matching button color	Matching colored token dropped	X	
90	PvC GW column 5 drop button drops token matching button color	Matching colored token dropped	X	
91	PvC GW column 6 drop button drops token matching button color	Matching colored token dropped	X	
92	PvC GW column 7 drop button drops token matching button color	Matching colored token dropped	X	
93	PVC GW computer automatically drops token in column 1 after player turn	Computer drops token	X	
94	PVC GW computer automatically drops token in column 2 after player turn	Computer drops token	X	
95	PVC GW computer automatically drops token in column 3 after player turn	Computer drops token	X	
96	PVC GW computer automatically drops token in column 4 after player turn	Computer drops token	X	
97	PVC GW computer automatically drops token in column 5 after player turn	Computer drops token	X	
98	PVC GW computer automatically drops token in column 6 after player turn	Computer drops token	X	
99	PVC GW computer automatically drops token in column 7 after player turn	Computer drops token	X	
100	PvC GW current player indicator changes on column 1 drop button click	Current player changes	X	
101	PvC GW current player indicator changes on column 2 drop button click	Current player changes	X	
102	PvC GW current player indicator changes on column 3 drop button click	Current player changes	X	
103	PvC GW current player indicator changes on column 4 drop button click	Current player changes	X	
104	PvC GW current player indicator changes on column 5 drop button click	Current player changes	X	
105	PvC GW current player indicator changes on column 6 drop button click	Current player changes	X	

106	PvC GW current player indicator changes on column 7 drop button click	Current player changes	X	
107	PvC GW token drops to lowest position open on column 1 drop button click	Token drops to lowest position open	X	
108	PvC GW token drops to lowest position open on column 2 drop button click	Token drops to lowest position open	X	
109	PvC GW token drops to lowest position open on column 3 drop button click	Token drops to lowest position open	X	
110	PvC GW token drops to lowest position open on column 4 drop button click	Token drops to lowest position open	X	
111	PvC GW token drops to lowest position open on column 5 drop button click	Token drops to lowest position open	X	
112	PvC GW token drops to lowest position open on column 6 drop button click	Token drops to lowest position open	X	
113	PvC GW token drops to lowest position open on column 7 drop button click	Token drops to lowest position open	X	
114	PvC GW column 1 drop button invisible when column full	Column 1 drop button invisible	X	
115	PvC GW column 2 drop button invisible when column full	Column 2 drop button invisible	X	
116	PvC GW column 3 drop button invisible when column full	Column 3 drop button invisible	X	
117	PvC GW column 4 drop button invisible when column full	Column 4 drop button invisible	X	
118	PvC GW column 5 drop button invisible when column full	Column 5 drop button invisible	X	
119	PvC GW column 6 drop button invisible when column full	Column 6 drop button invisible	X	
120	PvC GW column 7 drop button invisible when column full	Column 7 drop button invisible	X	
121	PvC GW draw game displayed when all columns full and no winner	Draw game displayed	X	
122	PvC GW end game button changes to new game button on draw	New game button replaces end game button	X	
123	PvC GW select game box displayed on new game button click	Select game box displayed	X	
124	PvC GW gameboard cleared on new button click	Gameboard cleared	X	
125	PvC GW winning player displayed on win	Winning player displayed	X	
126	PvC GW end game button changes to new game button on win	New game button replaces end game button	X	