Abstract:

An m,n,k-game is an abstract board game in which two players take turns in placing a stone of their color on an m×n board, the winner being the player who first gets k stones of their own color in a row, horizontally, vertically, or diagonally. m,n,k-game is also called a k-in-a-row game on m×n board. Thus,tic-tac-toe is the 3,3,3-game and connect-4 is a 4-4-4 game.

4,4,4-Game is a 2-player strategy game played on 4 X 4 board in which a player has to get 4 stones of his color in a row either horizontally, vertically or diagonally in order to win. Here I have taken 'X' as black stone and '0' as white stone.

Board description:

A typical board for 4-4-4 is as shown below:

11	12	13	14
21	22	23	24
31	32	33	34
41	42	43	44

A Typical 4 x 4 board

The board contains 4 rows and 4 columns respectively, with a total of 16 cells in it. Each player is supposed to place his symbol in the respective cell.

Logic Behind The Game:

Unlike the proposed work for research, this game is primarily developed on the brute-force-approach. The Computer that plays against a human user, basically finds each and every possible move and makes final decision to place his symbol. Current game has 2 possible modes.

(1) easy (2)hard

In EASY mode, computer simply finds all the possible empty cells and 'randomly' put his symbol on any of them thus making a good chance for human user to win. The mode was build during the initial development phase(when there was no hard mode) so I decided to keep it in the final version as well. Once the limitations of easy mode was identified (after 2-3 testing sessions), the need for a more advance and HARD mode was felt. So I included a more sophisticated code that could increase the sense of competitiveness.

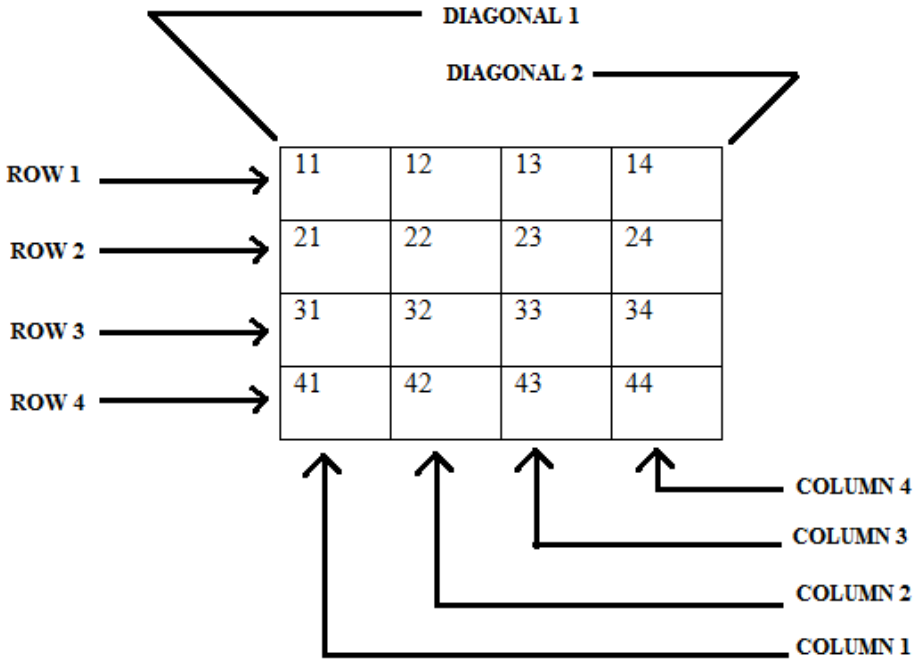
Approach followed to implement the same is described below.

Approach:

Since the board size was small, I included some variables to represent the main concerns

Variable	Represents	Variable	Represents
Pr1	Player-row-1	cr1	Computer-row-1
Pr4	Player-row-4	cr4	Computer -row-4
Pc1	Player-column-1	cc1	Computer-column-1
Pc4	Player-column-4	cc4	Computer-column-4
Pd1	Player-diagonal-1	cd1	Computer-diagonal-1
Pd2	Player-diagonal-2	cd2	Computer-diagonal-2

*where p/c--r/c/d—number can take values-0 1 2 3 4



Now the human-user will win if these conditions are fulfilled respectively.

pr1= =4||pr2= =4||pr3= =4||pr4= =4
or
pc1= =4||pc2= =4||pc3= =4||pc4= =4
or
pd1= =4||pd2= =4

or the computer will win if these conditions are fulfilled respectively.

cr1= =4||cr2= =4||cr3= =4||cr4= =4
or
cc1= =4||cc2= =4||cc3= =4||cc4= =4
or
cd1= =4||cd2= =4

Illustration:

if pr1= = 4 that would mean, player's row 1 is full and player has WON the game
likewise,
if cd1= = 4 that would mean, computer's diagonal 1 is full and computer has WON the game.

Deciding computer's current move:

The computer will decide its current move according to following criteria:

(1) Initially, it'll find the maximum value out of
set={pr1,pr2,pr3,pr4,pc1,pc2,pc3,pc4,pd1,pd2}

(2) it will then place its symbol to any of the cell which is 'vacant' and which belongs to the element whose value is maximum out the set.

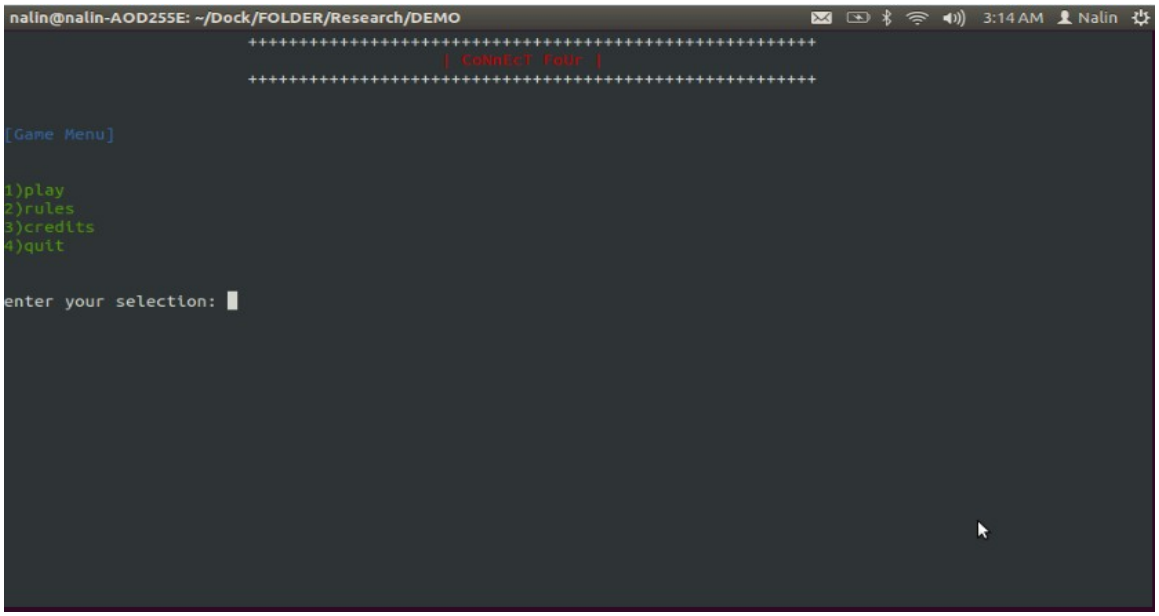
Illustration:

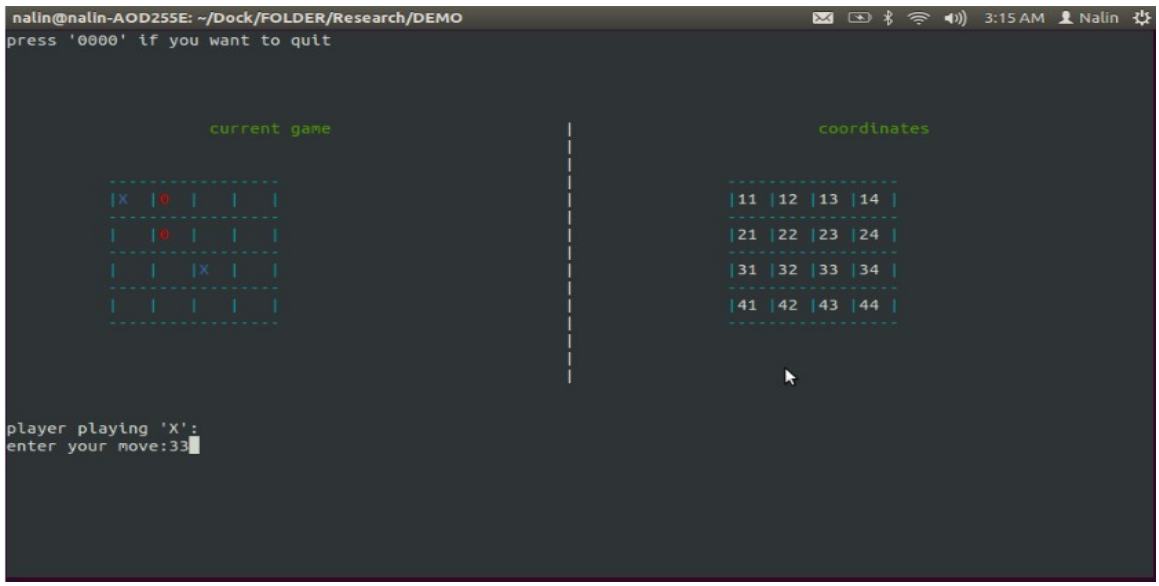
X(1)	X(5)	X(7)	O(8)
	X(3)	O(2)	
		O(4)	
	O(6)		

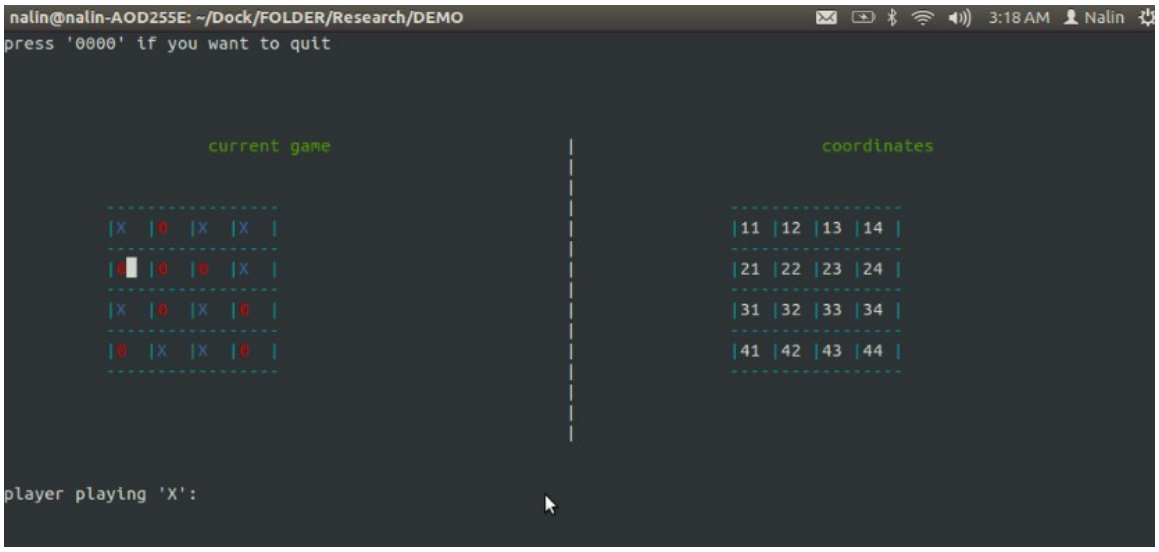
Pr1-3	pc1-1	pd1-2
pr2-1	pc2-2	pd2-0
pr3-0	pc3-1	
pr4-0	pc4-0	

The 8th move of game is supposed to be played from computer's side.
For this, it selects the maximum element from set, which is pr1 and places its symbol on any of the cell which is empty i.e. 14. Thats how the entire Decision Making is achieved.

Screenshots:


nalin@nalin-AOD255E: ~/Dock/FOLDER/Research/DEMO
3:14 AM Nalin
++
| CoNnEcT FoUr |
++
[Game Menu]
1)play
2)rules
3)credits
4)quit
enter your selection:


nalin@nalin-AOD255E: ~/Dock/FOLDER/Research/DEMO
3:15 AM Nalin
press '0000' if you want to quit
current game
coordinates
X	0		
	0		
		X	
11	12	13	14
21	22	23	24
31	32	33	34
41	42	43	44
player playing 'X':
enter your move:33


nalin@nalin-AOD255E: ~/Dock/FOLDER/Research/DEMO
3:18 AM Nalin
press '0000' if you want to quit
current game
coordinates
X	0	X	X
0	0	0	X
X	0	X	0
0	X	X	0
11	12	13	14
21	22	23	24
31	32	33	34
41	42	43	44
player playing 'X':