ARTIFICIAL INTELLIGENCE

ASSIGNMENT 1

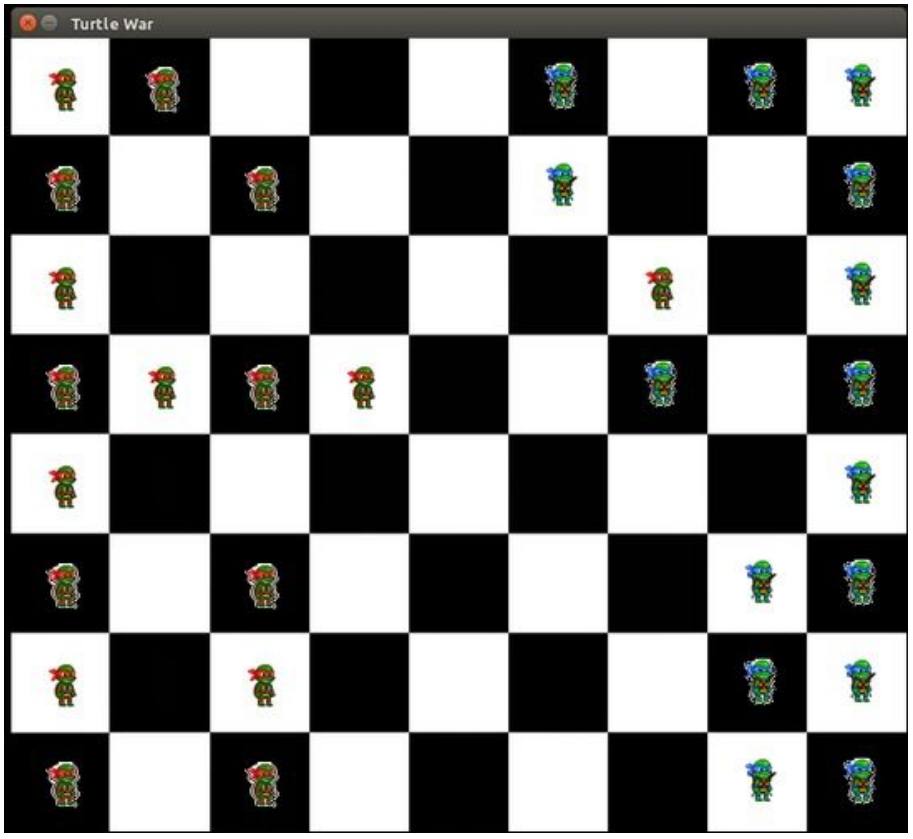
TURTLE WAR

REPORT BY -

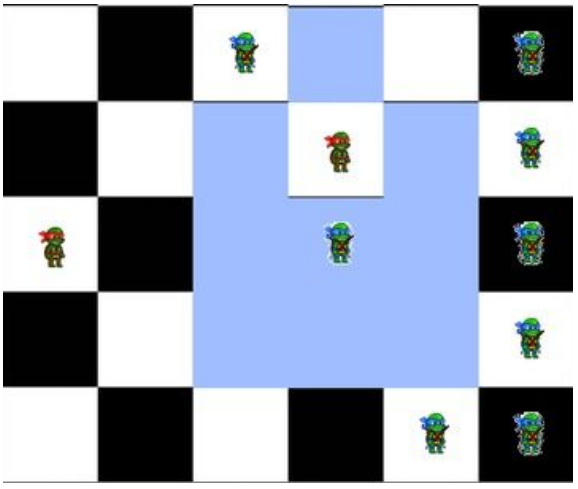
RAJAT MANGLA - (B15CS029)

VINAYAK SINGLA - (B15CS039)

1. INTRODUCTION - GAME PLAY

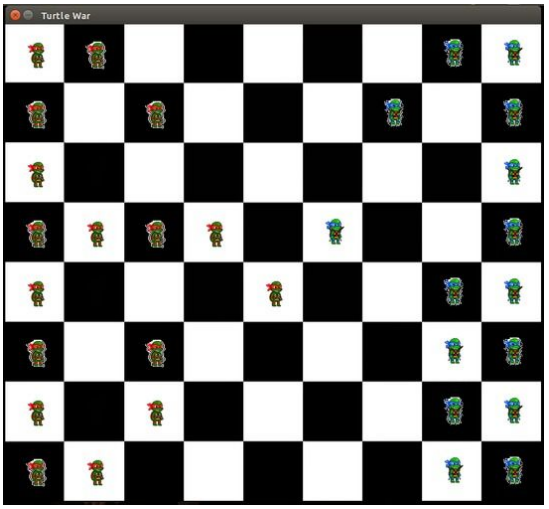


TURTLE WAR: We try to simulate the TURTLE GAME under specified constraints.
The game can be run by running the Python file 'bonus.py'.
After that, the game then starts with a board of red and blue turtles.
RED TURTLES - MiniMax AI Bot (With Alpha-Beta Pruning)
BLUE TURTLES - Human
To make a move, click on any **BLUE Coloured** turtle. All the possible valid moves resulting in final positions are shown in cyan colour.

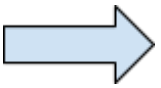


Click on one of the cyan coloured boxes to make the move. Diagonal moves are diagonal captures are also incorporated.

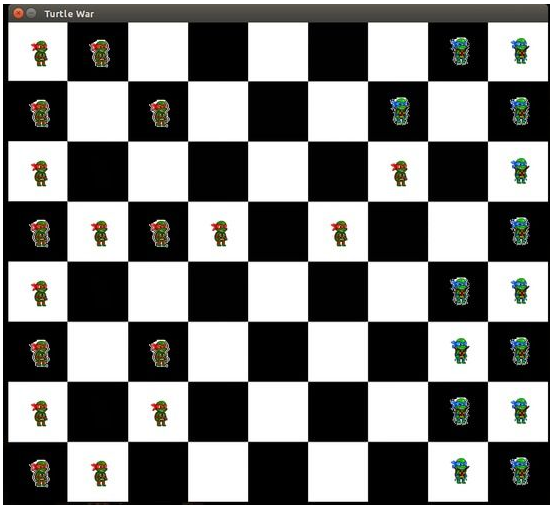
Sample Moves related to the game are:



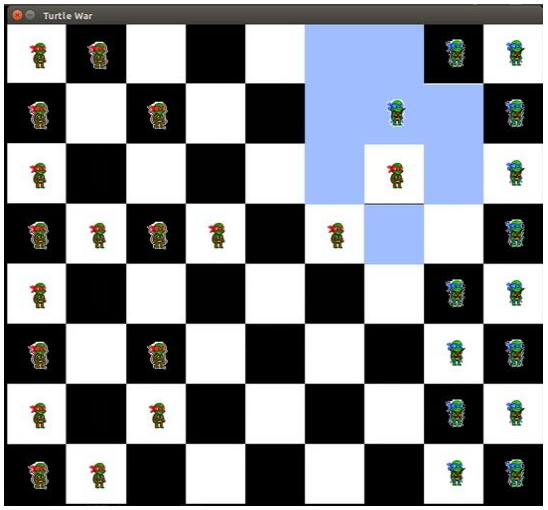
(a)



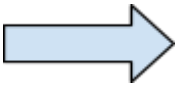
Attack
(in diagonally)



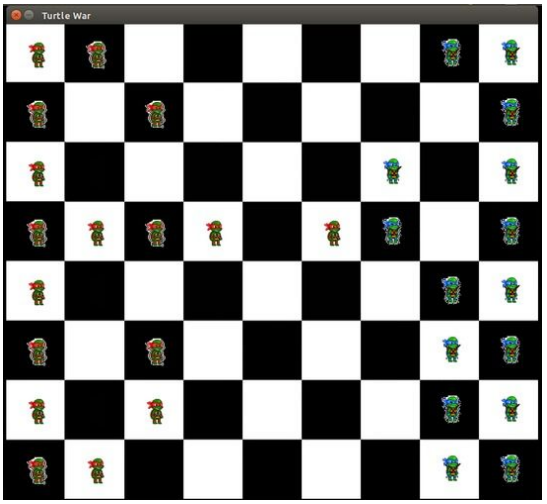
(b)



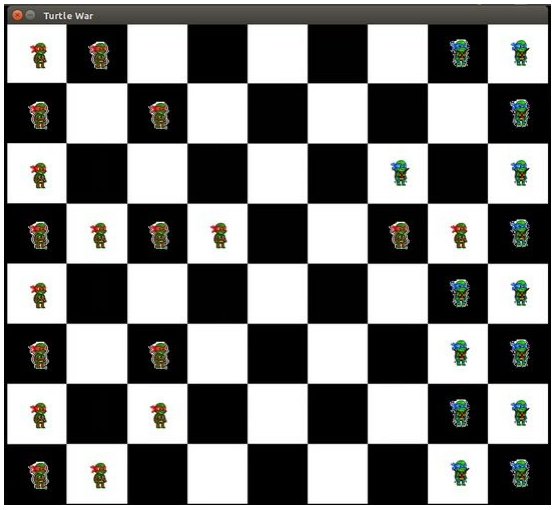
(c)



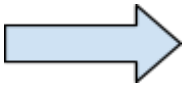
Attack
(in horizontal)



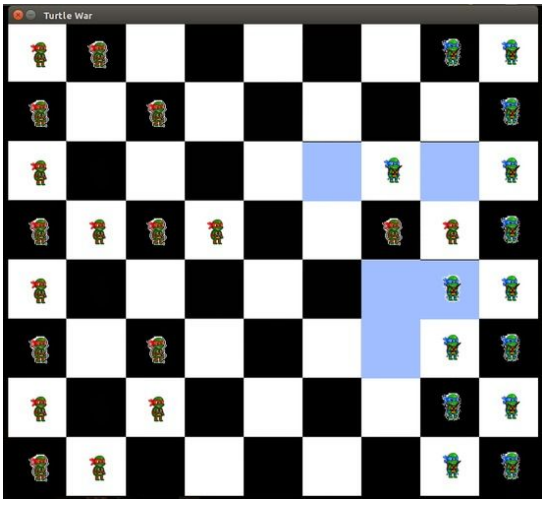
(d)



(e)



Attack
(in vertical)



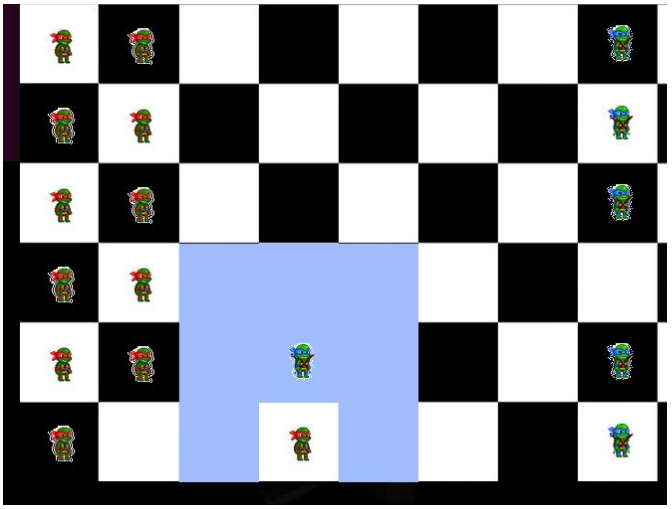
(f)

2. Heuristic Choice

The heuristic we chose for the bot for the evaluate function are:

A. H1 = (Number of bot's turtles - Number of opponents turtles), higher the value of H1 more the board is favourable for the bot.

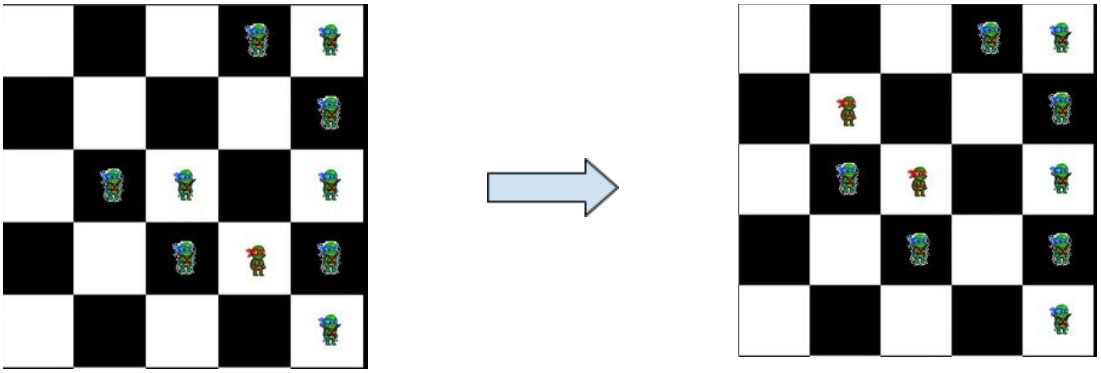
B. H2 = Count of no. of blockings per direction per turtle
In the given example below red turtle is blocked in the following directions
   I. Vertical
   II. Both diagonal positions



So, here for this particular turtle, blocking score will be (3*0.2), Here the only to convince the turtle is to jump on it in horizontal direction. So we can say that if we have more directions in which the movement for opposite coloured turtle is blocked more is better.

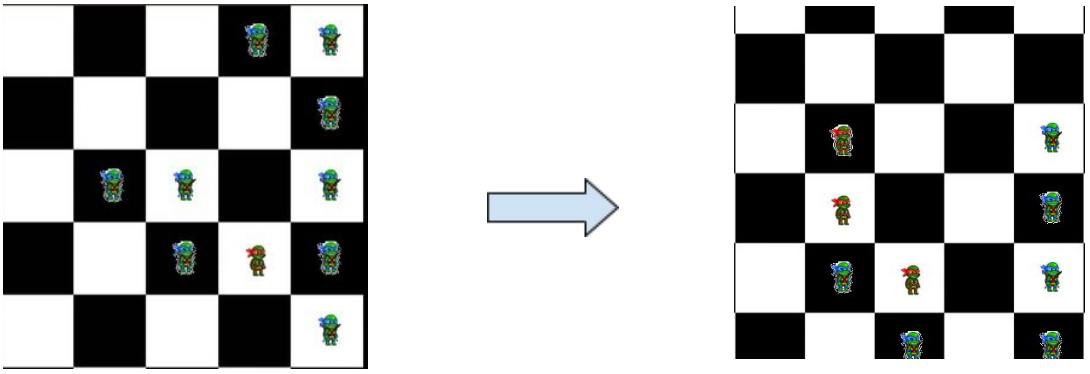
C. H3 = Sum of Count of No of opposite coloured turtles attacked per bot turtle - In this two cases arises -

a. Turtle who after an attack goes into unsafe position as shown below



Red turtle after attacking blue one goes into unsafe position

b. Turtle who after an attack goes into safe position as shown below



Red turtle after attacking blue one goes into a safe position

Note : The cutoff value for heuristic was 2 ply so it will be again bot's turn to attack when evaluating

3. Win Statistics and Loss Analysis

We simulated our Alpha Beta Minimax Bot algorithm against **RANDOM BOT** 100 times and following results were found out :

CASE 1 - Heuristic = H1

Win Percentage = 100%

Average moves to defeat = 99

CASE 2 - Heuristic = H1 + H2

Win Percentage = 100%

Average moves to defeat = 121

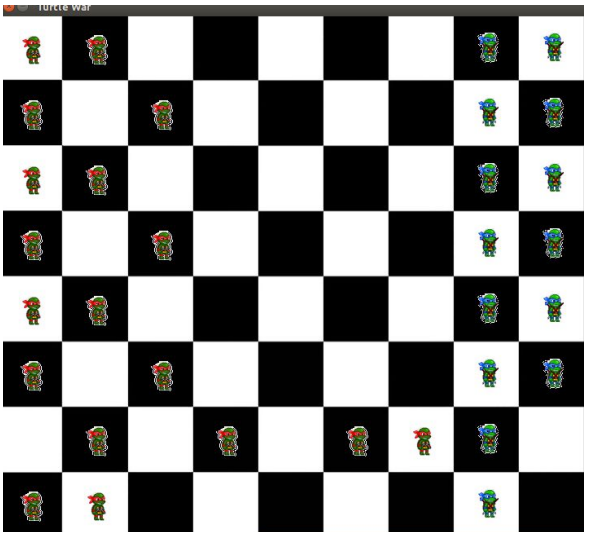
CASE 3 - Heuristic = H1 + H2 + H3

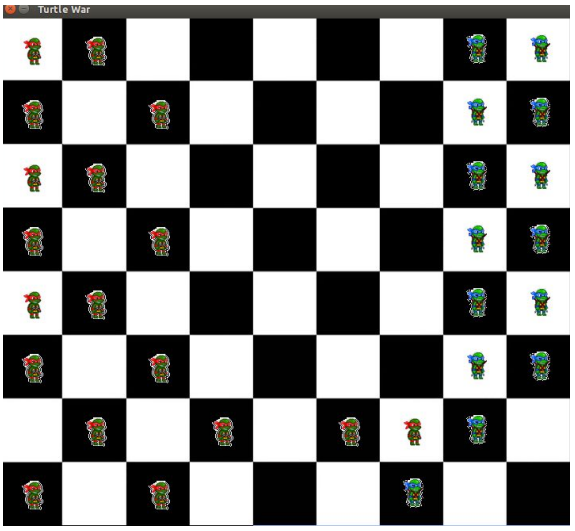
Win Percentage = 100%

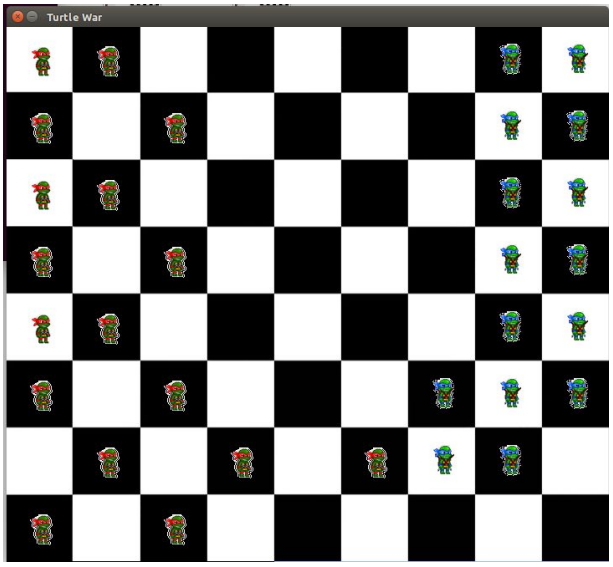
Average moves to defeat = 38

The final heuristic chosen was H1 + H2 + H3 though it becomes **computationally expensive** but the performance in number of moves to defeat opponent **improves significantly.**

The basic problem with bot found out by playing against it in BOT vs HUMAN mode is because of 2 ply cutoff he isn't able to plan much ahead in future and therefore is not performing too well against humans as it performed against random but the performance was still acceptable.







The red turtle in 1st figure isn't attacking as if he attacks he will be killed but when we move the blue turtle in figure 2 his turtle was going to get killed no matter what happens so he should have tried to attack the blue turtle but as he wasn't able to think ahead of 2 plies so he does a very wrong move.