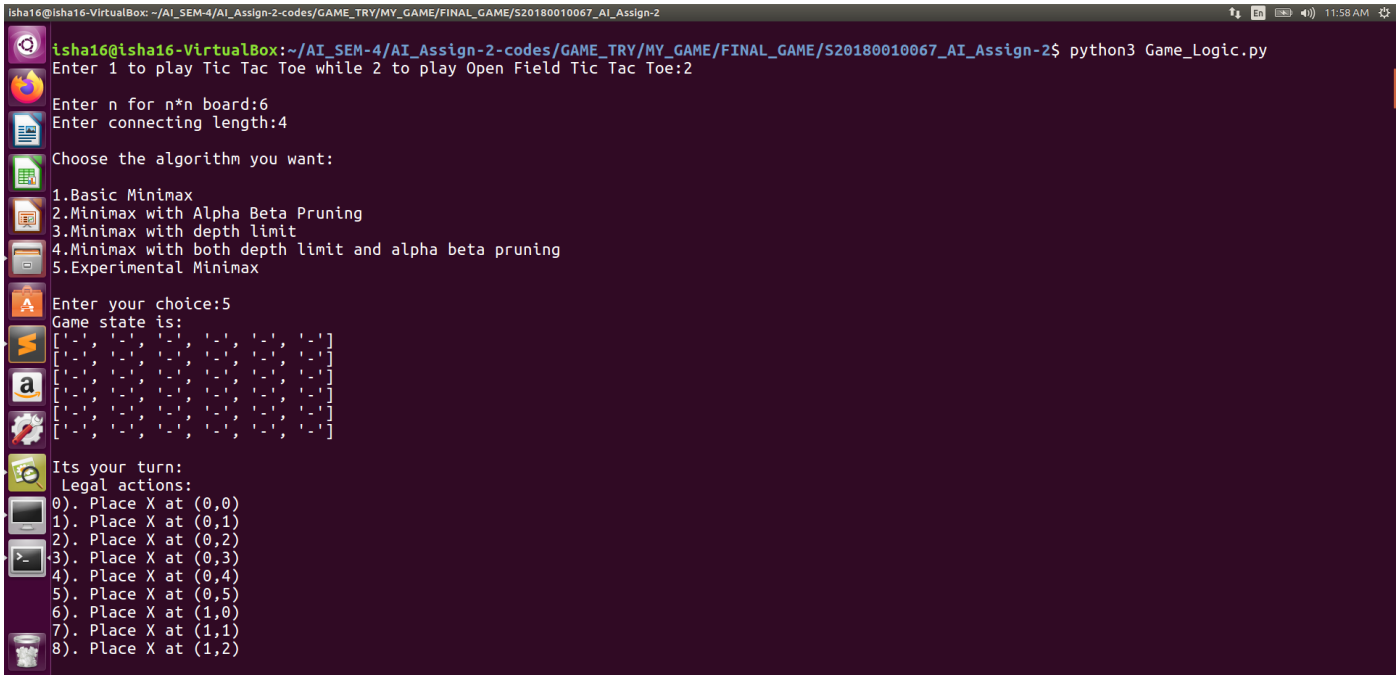
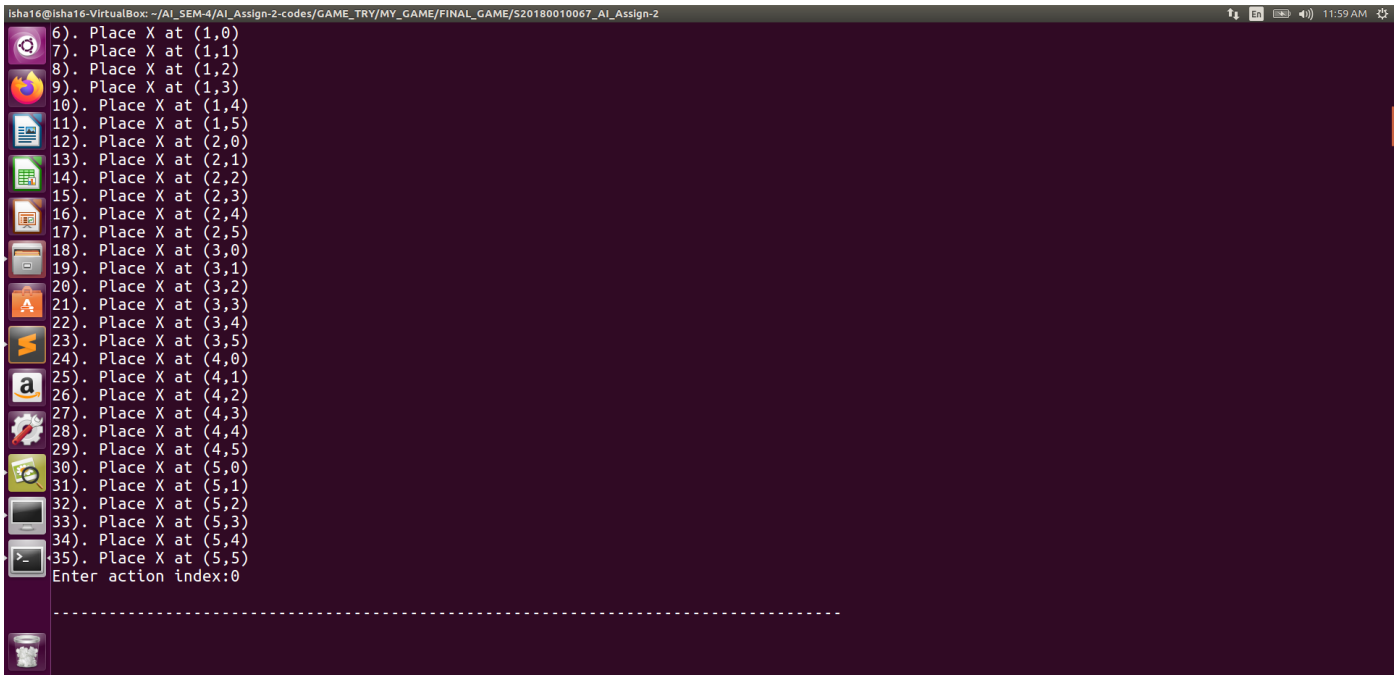
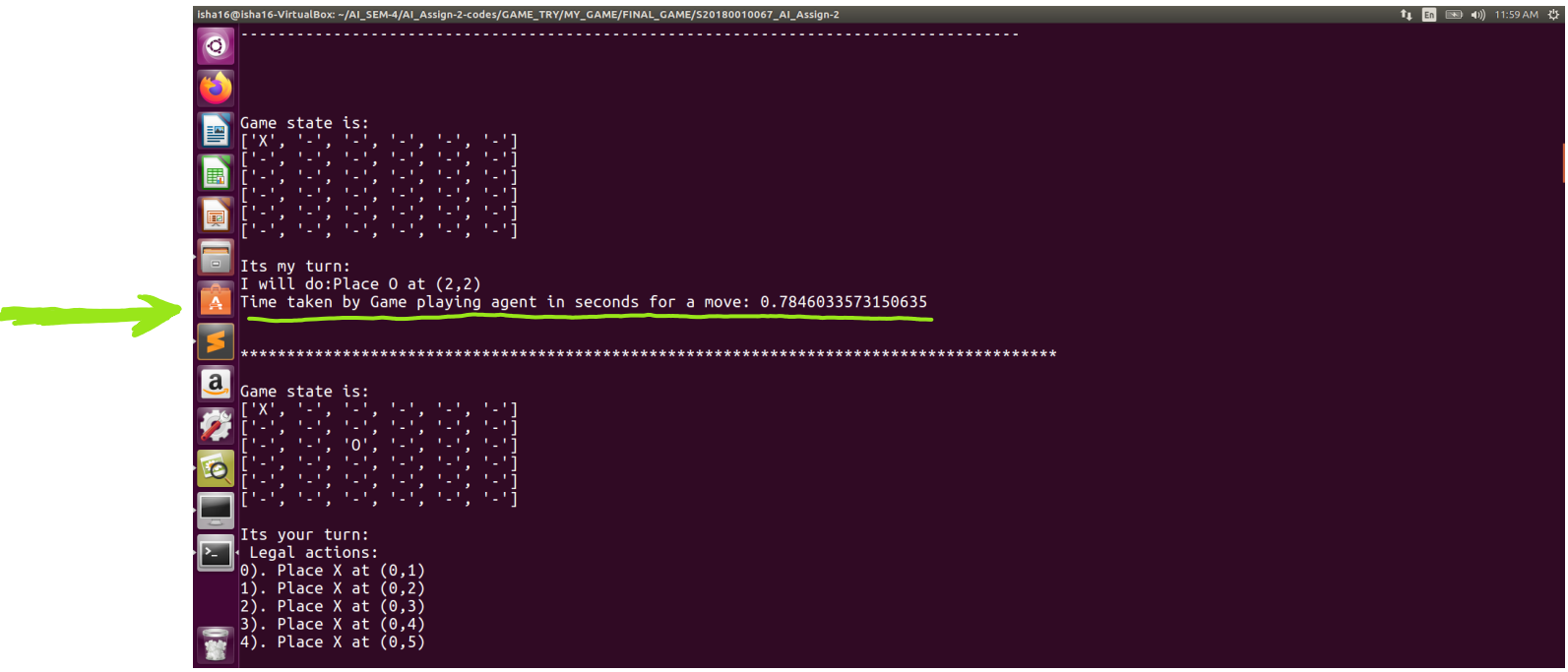
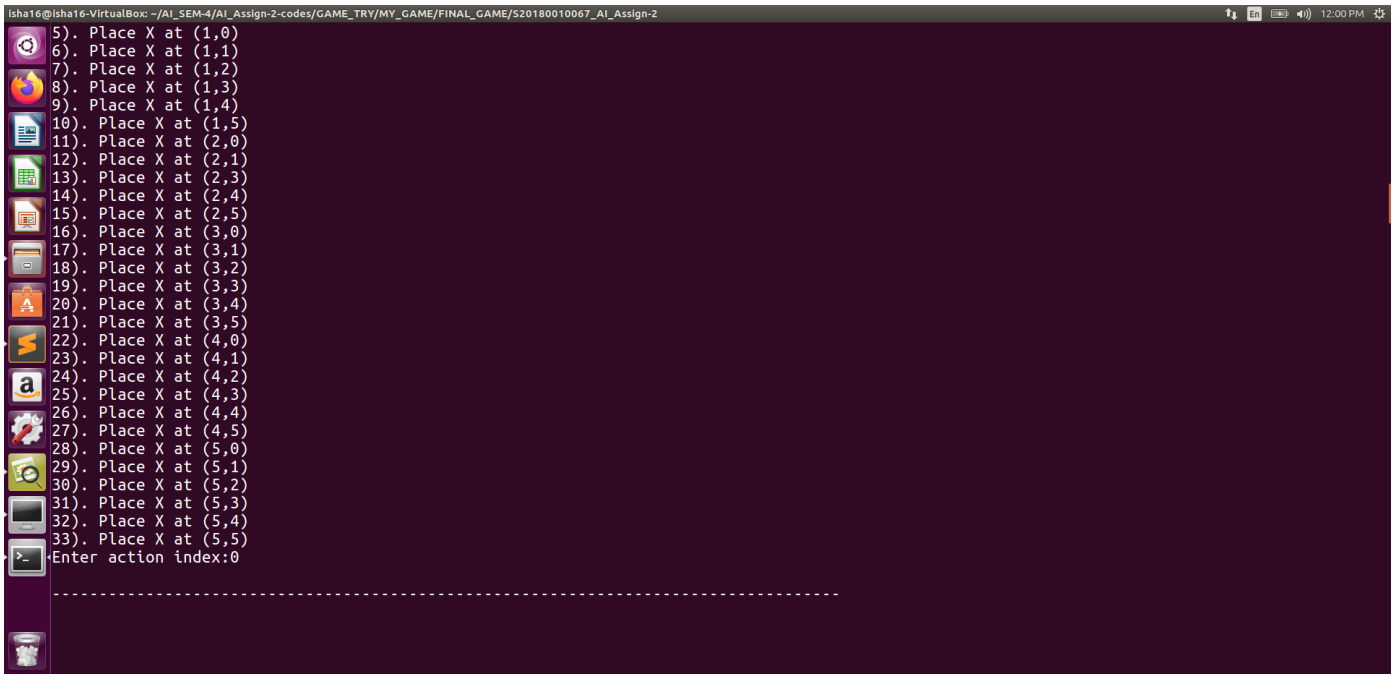
Proof: The algorithm 5 – “Experimental Minimax is better than all others”.

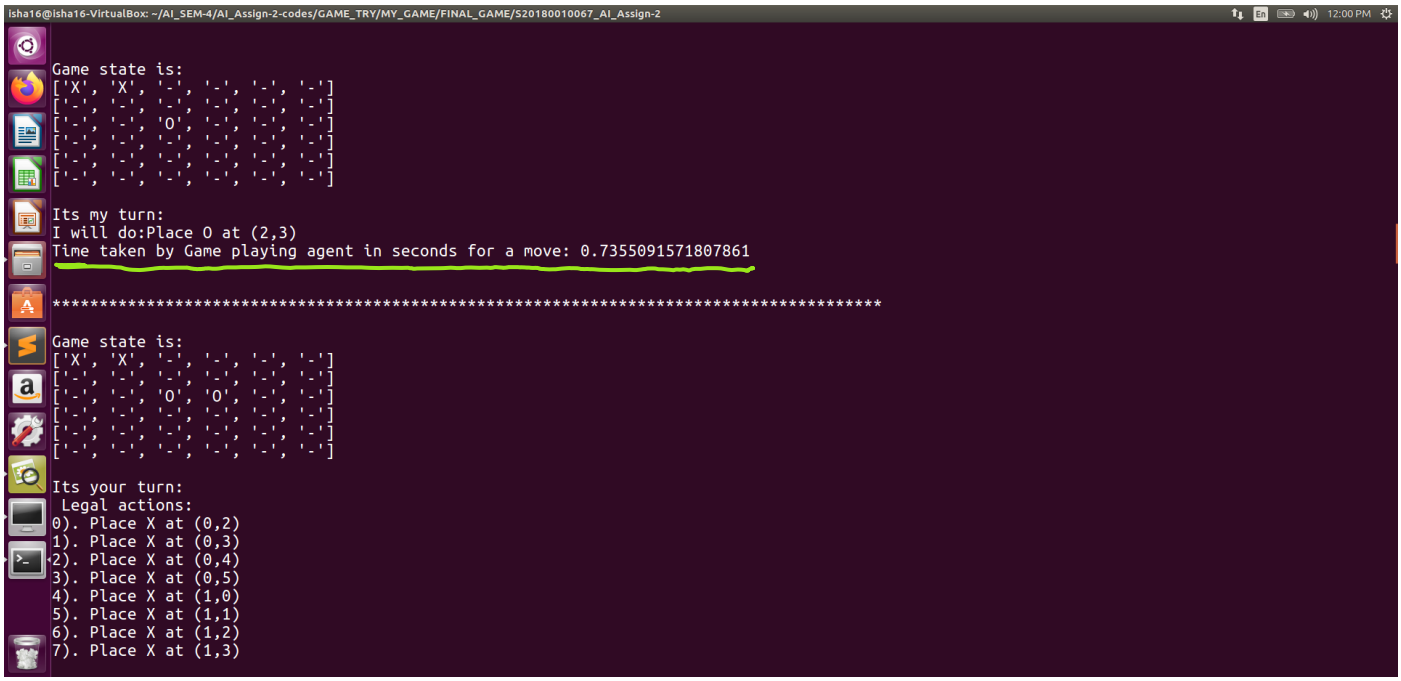
This can be seen from the time taken by the game playing agent in each of its move. The time taken (in seconds) has been highlighted in the following screenshots. Also, playing open field tic tac toe on a board size such as 6*6 is completely infeasible, with AI using other algorithms. This clearly proves that Experimental Minimax is better than others.

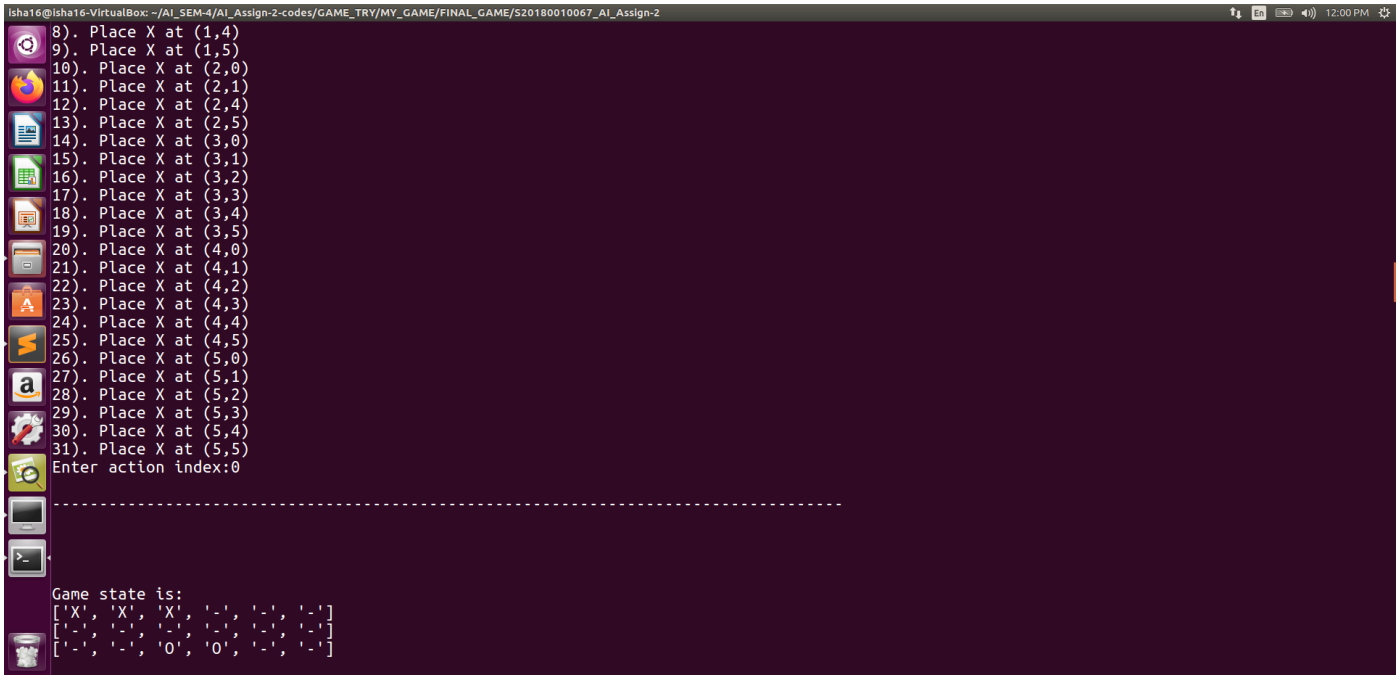




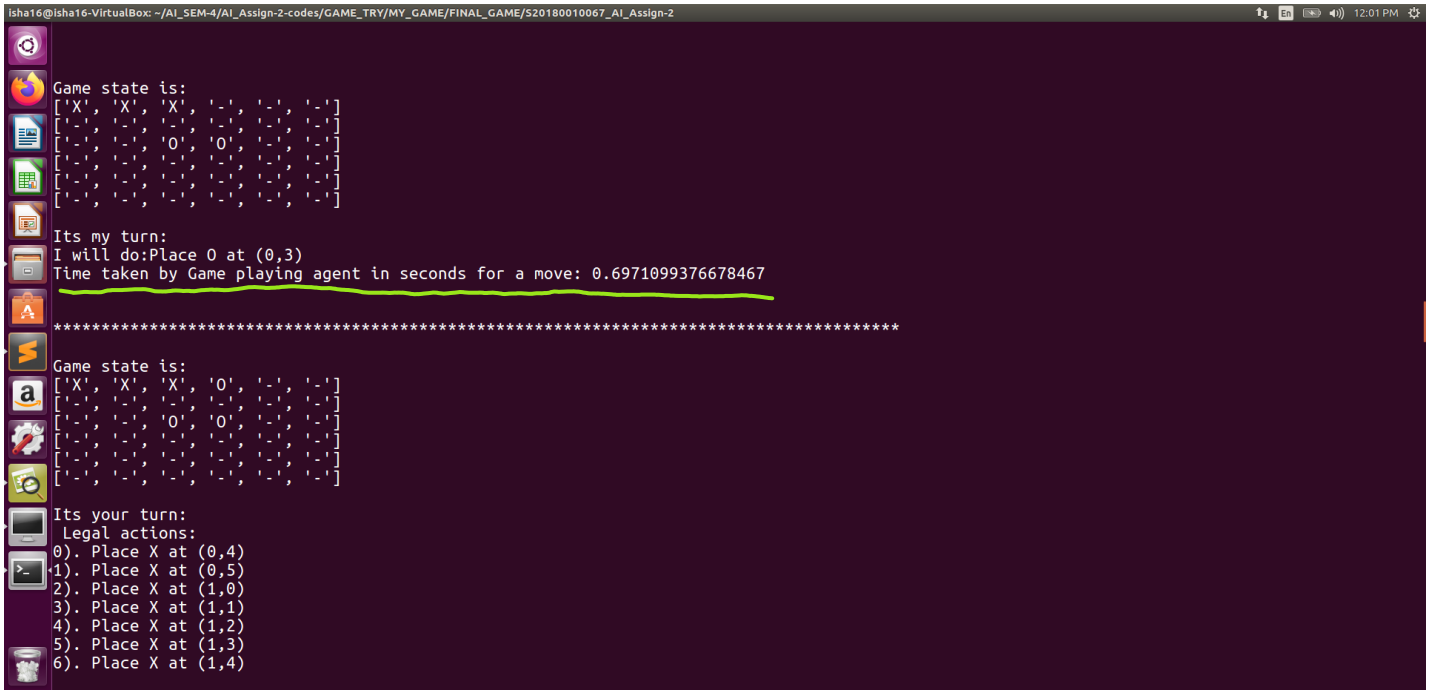

isha16@isha16-VirtualBox: ~/AI_SEM-4/AI_Assign-2-codes/GAME_TRY/MY_GAME/FINAL_GAME/S20180010067_AI_Assign-2
11:59 AM
Game state is:
['X', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
Its my turn:
I will do:Place O at (2,2)
Time taken by Game playing agent in seconds for a move: 0.7846033573150635
Game state is:
['X', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', 'O', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
Its your turn:
Legal actions:
0). Place X at (0,1)
1). Place X at (0,2)
2). Place X at (0,3)
3). Place X at (0,4)
4). Place X at (0,5)

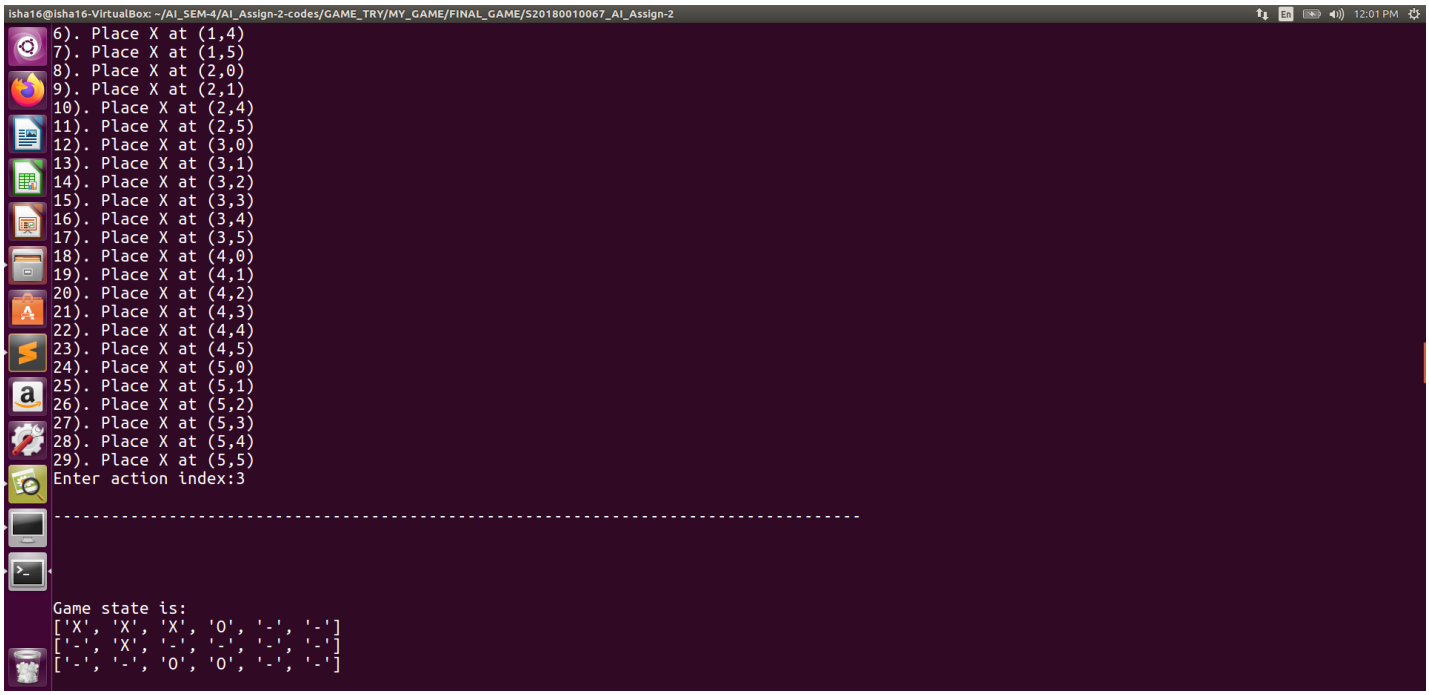

isha16@isha16-VirtualBox: ~/AI_SEM-4/AI_Assign-2-codes/GAME_TRY/MY_GAME/FINAL_GAME/S20180010067_AI_Assign-2
12:00 PM
5). Place X at (1,0)
6). Place X at (1,1)
7). Place X at (1,2)
8). Place X at (1,3)
9). Place X at (1,4)
10). Place X at (1,5)
11). Place X at (2,0)
12). Place X at (2,1)
13). Place X at (2,3)
14). Place X at (2,4)
15). Place X at (2,5)
16). Place X at (3,0)
17). Place X at (3,1)
18). Place X at (3,2)
19). Place X at (3,3)
20). Place X at (3,4)
21). Place X at (3,5)
22). Place X at (4,0)
23). Place X at (4,1)
24). Place X at (4,2)
25). Place X at (4,3)
26). Place X at (4,4)
27). Place X at (4,5)
28). Place X at (5,0)
29). Place X at (5,1)
30). Place X at (5,2)
31). Place X at (5,3)
32). Place X at (5,4)
33). Place X at (5,5)
Enter action index:0


isha16@isha16-VirtualBox: ~/AI_SEM-4/AI_Assign-2-codes/GAME_TRY/MY_GAME/FINAL_GAME/S20180010067_AI_Assign-2
12:00 PM
Game state is:
['X', 'X', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', 'O', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
Its my turn:
I will do:Place O at (2,3)
Time taken by Game playing agent in seconds for a move: 0.7355091571807861
****
Game state is:
['X', 'X', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', 'O', 'O', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
Its your turn:
Legal actions:
0). Place X at (0,2)
1). Place X at (0,3)
2). Place X at (0,4)
3). Place X at (0,5)
4). Place X at (1,0)
5). Place X at (1,1)
6). Place X at (1,2)
7). Place X at (1,3)

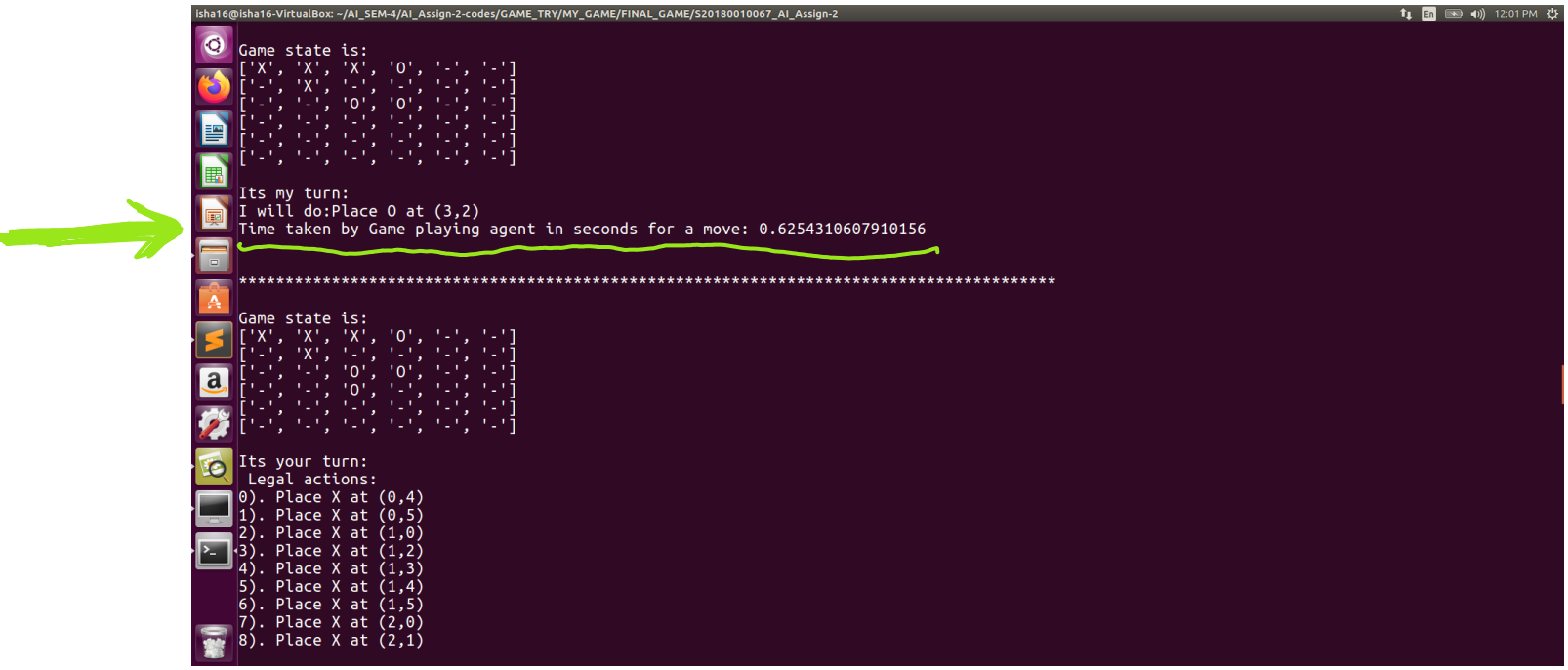

isha16@isha16-VirtualBox: ~/AI_SEM-4/AI_Assign-2-codes/GAME_TRY/MY_GAME/FINAL_GAME/S20180010067_AI_Assign-2
12:00 PM
8). Place X at (1,4)
9). Place X at (1,5)
10). Place X at (2,0)
11). Place X at (2,1)
12). Place X at (2,4)
13). Place X at (2,5)
14). Place X at (3,0)
15). Place X at (3,1)
16). Place X at (3,2)
17). Place X at (3,3)
18). Place X at (3,4)
19). Place X at (3,5)
20). Place X at (4,0)
21). Place X at (4,1)
22). Place X at (4,2)
23). Place X at (4,3)
24). Place X at (4,4)
25). Place X at (4,5)
26). Place X at (5,0)
27). Place X at (5,1)
28). Place X at (5,2)
29). Place X at (5,3)
30). Place X at (5,4)
31). Place X at (5,5)
Enter action index:0

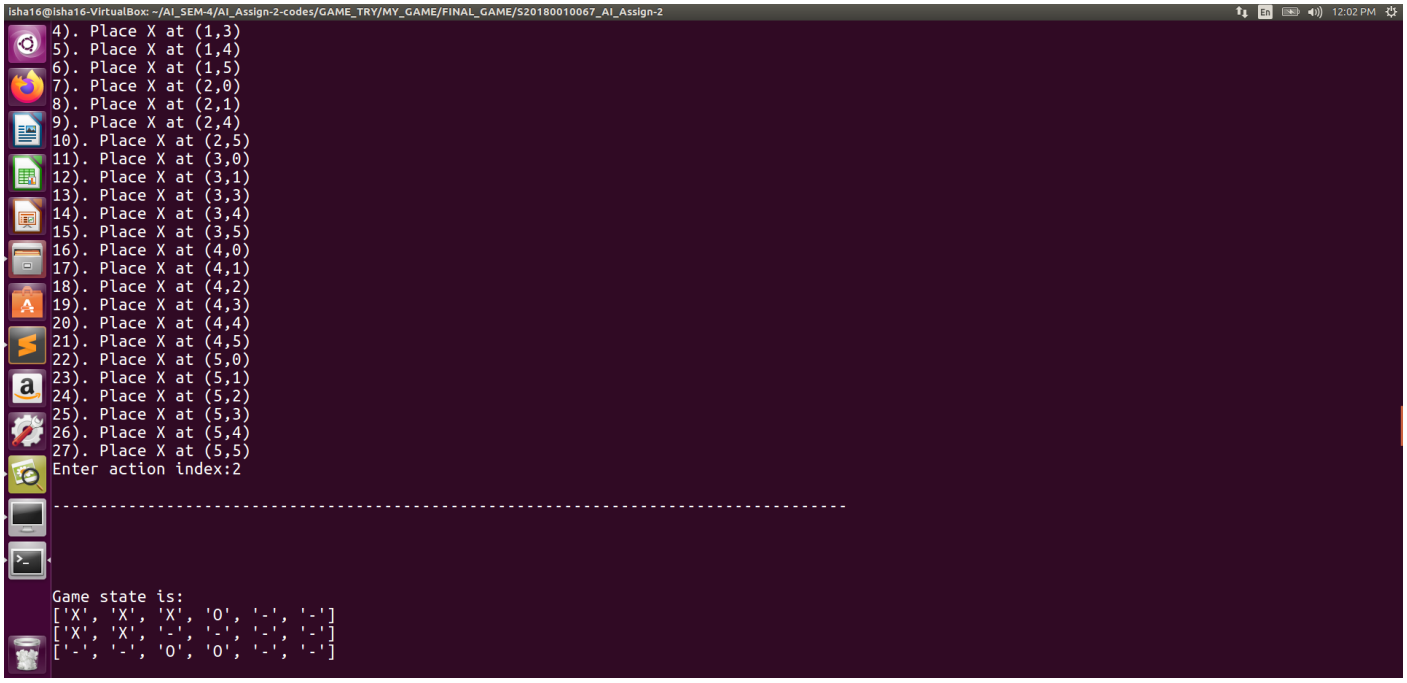
Game state is:
['X', 'X', 'X', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', 'O', 'O', '-', '-']

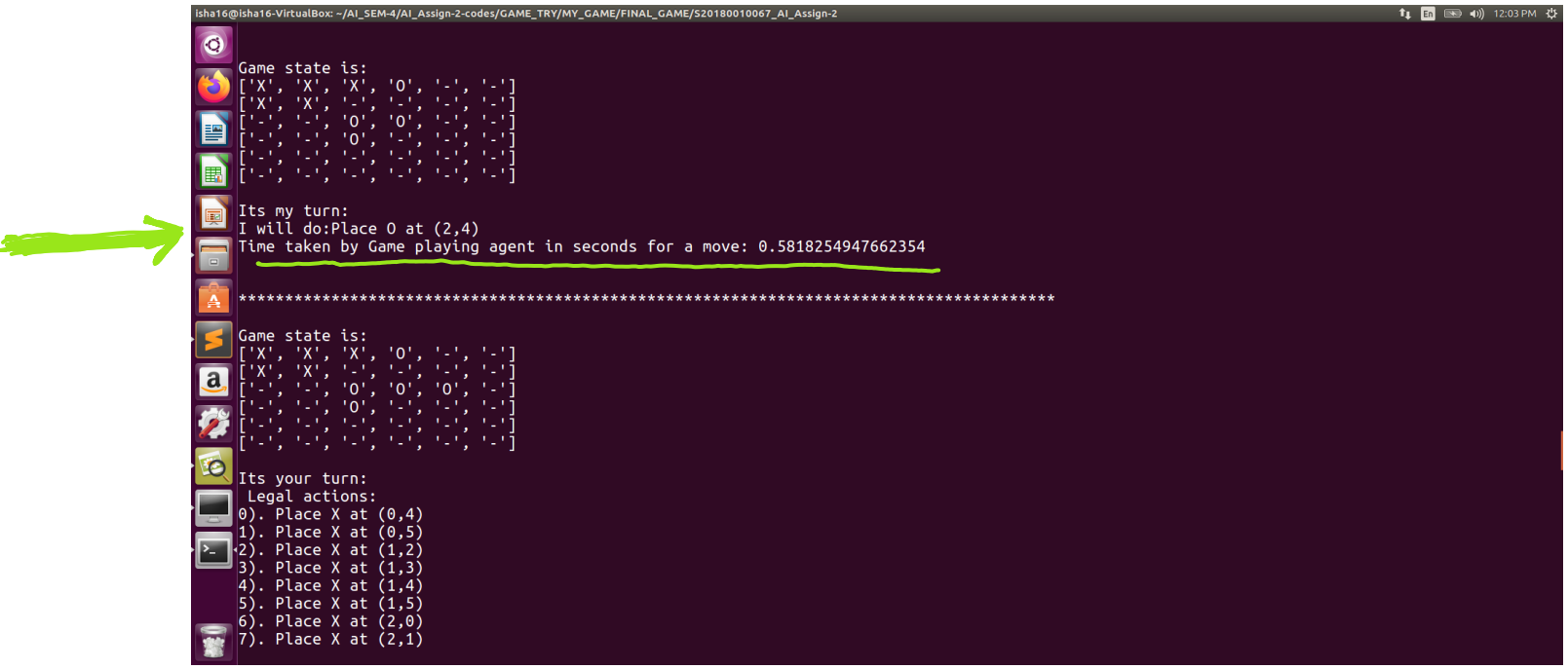

isha16@isha16-VirtualBox: ~/AI_SEM-4/AI_Assign-2-codes/GAME_TRY/MY_GAME/FINAL_GAME/S20180010067_AI_Assign-2
12:01 PM
Game state is:
['X', 'X', 'X', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', 'O', 'O', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
Its my turn:
I will do:Place O at (0,3)
Time taken by Game playing agent in seconds for a move: 0.6971099376678467
****
Game state is:
['X', 'X', 'X', 'O', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', 'O', 'O', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
Its your turn:
Legal actions:
0). Place X at (0,4)
1). Place X at (0,5)
2). Place X at (1,0)
3). Place X at (1,1)
4). Place X at (1,2)
5). Place X at (1,3)
6). Place X at (1,4)

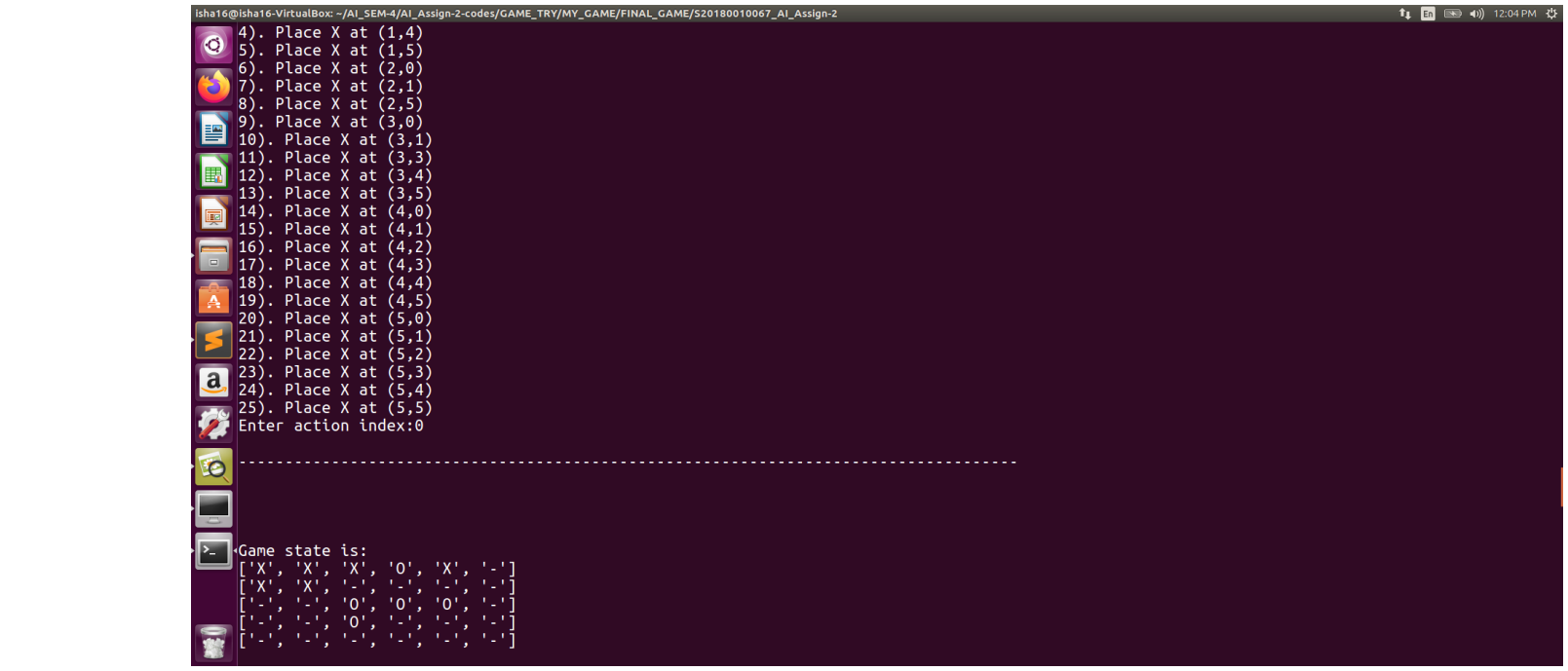

isha16@isha16-VirtualBox: ~/AI_SEM-4/AI_Assign-2-codes/GAME_TRY/MY_GAME/FINAL_GAME/S20180010067_AI_Assign-2
12:01 PM
6). Place X at (1,4)
7). Place X at (1,5)
8). Place X at (2,0)
9). Place X at (2,1)
10). Place X at (2,4)
11). Place X at (2,5)
12). Place X at (3,0)
13). Place X at (3,1)
14). Place X at (3,2)
15). Place X at (3,3)
16). Place X at (3,4)
17). Place X at (3,5)
18). Place X at (4,0)
19). Place X at (4,1)
20). Place X at (4,2)
21). Place X at (4,3)
22). Place X at (4,4)
23). Place X at (4,5)
24). Place X at (5,0)
25). Place X at (5,1)
26). Place X at (5,2)
27). Place X at (5,3)
28). Place X at (5,4)
29). Place X at (5,5)
Enter action index:3

Game state is:
['X', 'X', 'X', 'O', '-', '-']
['-', 'X', '-', '-', '-', '-']
['-', '-', 'O', 'O', '-', '-']

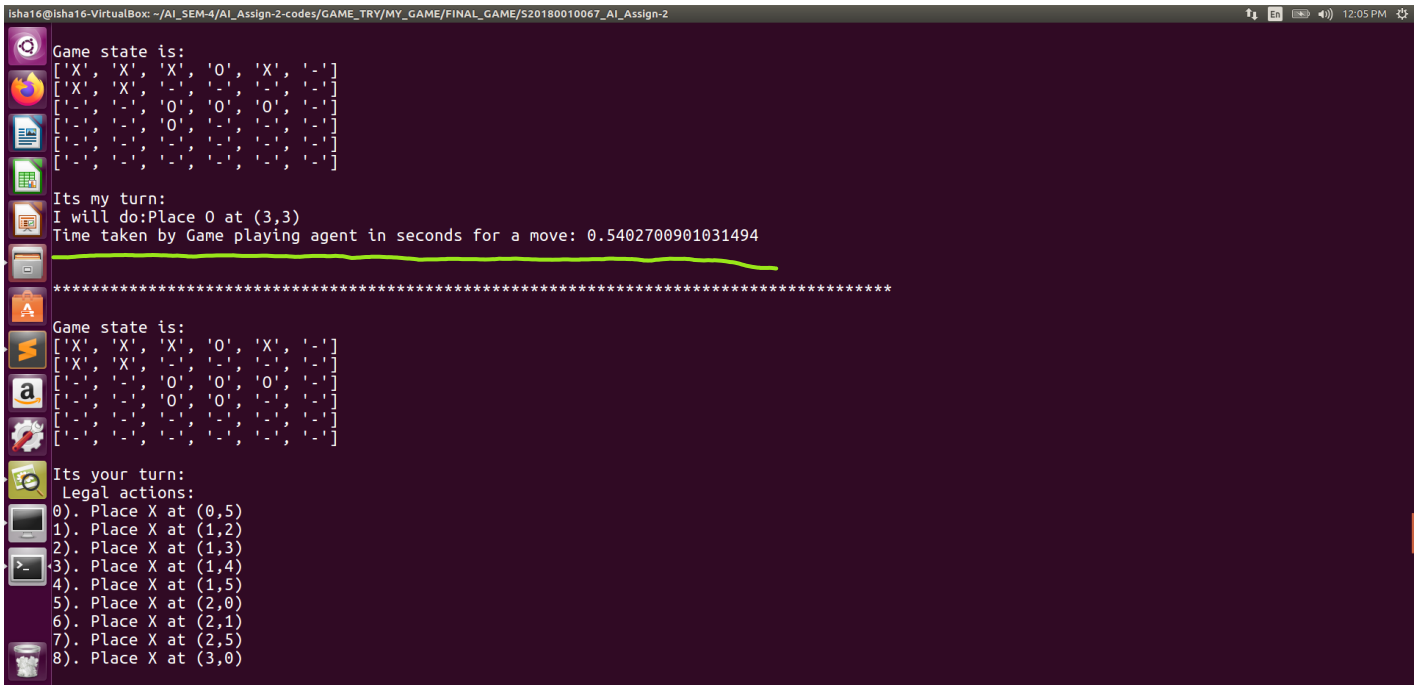

isha16@isha16-VirtualBox: ~/AI_SEM-4/AI_Assign-2-codes/GAME_TRY/MY_GAME/FINAL_GAME/S20180010067_AI_Assign-2
12:01 PM
Game state is:
['X', 'X', 'X', 'O', '-', '-']
['-', 'X', '-', '-', '-', '-']
['-', '-', 'O', 'O', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
Its my turn:
I will do:Place O at (3,2)
Time taken by Game playing agent in seconds for a move: 0.6254310607910156
****
Game state is:
['X', 'X', 'X', 'O', '-', '-']
['-', 'X', '-', '-', '-', '-']
['-', '-', 'O', 'O', '-', '-']
['-', '-', 'O', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
Its your turn:
Legal actions:
0). Place X at (0,4)
1). Place X at (0,5)
2). Place X at (1,0)
3). Place X at (1,2)
4). Place X at (1,3)
5). Place X at (1,4)
6). Place X at (1,5)
7). Place X at (2,0)
8). Place X at (2,1)

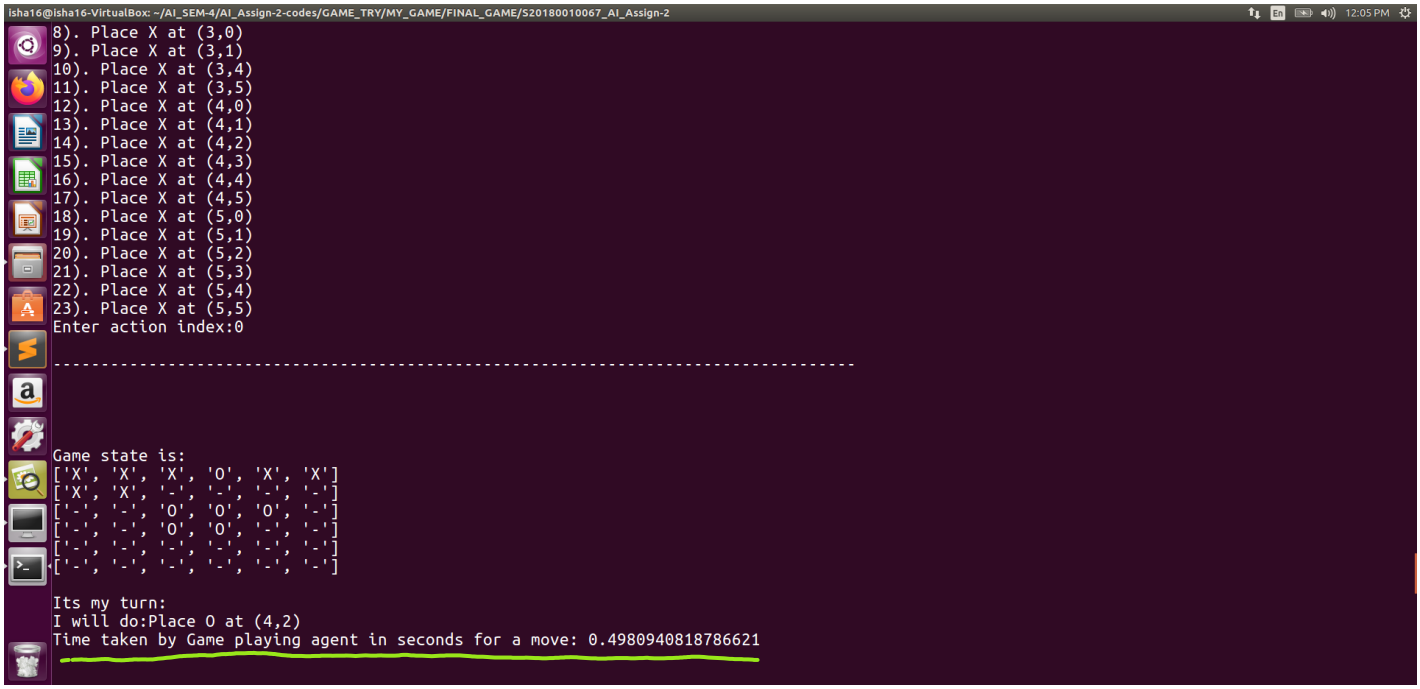

isha16@isha16-VirtualBox: ~/AI_SEM-4/AI_Assign-2-codes/GAME_TRY/MY_GAME/FINAL_GAME/S20180010067_AI_Assign-2
12:02 PM
4). Place X at (1,3)
5). Place X at (1,4)
6). Place X at (1,5)
7). Place X at (2,0)
8). Place X at (2,1)
9). Place X at (2,4)
10). Place X at (2,5)
11). Place X at (3,0)
12). Place X at (3,1)
13). Place X at (3,3)
14). Place X at (3,4)
15). Place X at (3,5)
16). Place X at (4,0)
17). Place X at (4,1)
18). Place X at (4,2)
19). Place X at (4,3)
20). Place X at (4,4)
21). Place X at (4,5)
22). Place X at (5,0)
23). Place X at (5,1)
24). Place X at (5,2)
25). Place X at (5,3)
26). Place X at (5,4)
27). Place X at (5,5)
Enter action index:2
Game state is:
['X', 'X', 'X', 'O', '-', '-']
['X', 'X', '-', '-', '-', '-']
['-', '-', 'O', 'O', '-', '-']


isha16@isha16-VirtualBox: ~/AI_SEM-4/AI_Assign-2-codes/GAME_TRY/MY_GAME/FINAL_GAME/S20180010067_AI_Assign-2
12:03 PM
Game state is:
['X', 'X', 'X', 'O', '-', '-']
['X', 'X', '-', '-', '-', '-']
['-', '-', 'O', 'O', '-', '-']
['-', '-', 'O', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
Its my turn:
I will do:Place O at (2,4)
Time taken by Game playing agent in seconds for a move: 0.5818254947662354
****
Game state is:
['X', 'X', 'X', 'O', '-', '-']
['X', 'X', '-', '-', '-', '-']
['-', '-', 'O', 'O', 'O', '-']
['-', '-', 'O', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
Its your turn:
Legal actions:
0). Place X at (0,4)
1). Place X at (0,5)
2). Place X at (1,2)
3). Place X at (1,3)
4). Place X at (1,4)
5). Place X at (1,5)
6). Place X at (2,0)
7). Place X at (2,1)


isha16@isha16-VirtualBox: ~/AI_SEM-4/AI_Assign-2-codes/GAME_TRY/MY_GAME/FINAL_GAME/S20180010067_AI_Assign-2
12:04 PM
4). Place X at (1,4)
5). Place X at (1,5)
6). Place X at (2,0)
7). Place X at (2,1)
8). Place X at (2,5)
9). Place X at (3,0)
10). Place X at (3,1)
11). Place X at (3,3)
12). Place X at (3,4)
13). Place X at (3,5)
14). Place X at (4,0)
15). Place X at (4,1)
16). Place X at (4,2)
17). Place X at (4,3)
18). Place X at (4,4)
19). Place X at (4,5)
20). Place X at (5,0)
21). Place X at (5,1)
22). Place X at (5,2)
23). Place X at (5,3)
24). Place X at (5,4)
25). Place X at (5,5)
Enter action index:0

Game state is:
['X', 'X', 'X', 'O', 'X', '-']
['X', 'X', '-', '-', '-', '-']
['-', '-', 'O', 'O', 'O', '-']
['-', '-', 'O', '-', '-', '-']
['-', '-', '-', '-', '-', '-']


isha16@isha16-VirtualBox: ~/AI_SEM-4/AI_Assign-2-codes/GAME_TRY/MY_GAME/FINAL_GAME/S20180010067_AI_Assign-2
12:05 PM
Game state is:
['X', 'X', 'X', 'O', 'X', '-']
['X', 'X', '-', '-', '-', '-']
['-', '-', 'O', 'O', 'O', '-']
['-', '-', 'O', 'O', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
Its my turn:
I will do:Place O at (3,3)
Time taken by Game playing agent in seconds for a move: 0.5402700901031494
****
Game state is:
['X', 'X', 'X', 'O', 'X', '-']
['X', 'X', '-', '-', '-', '-']
['-', '-', 'O', 'O', 'O', '-']
['-', '-', 'O', 'O', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
Its your turn:
Legal actions:
0). Place X at (0,5)
1). Place X at (1,2)
2). Place X at (1,3)
3). Place X at (1,4)
4). Place X at (1,5)
5). Place X at (2,0)
6). Place X at (2,1)
7). Place X at (2,5)
8). Place X at (3,0)


isha16@isha16-VirtualBox: ~/AI_SEM-4/AI_Assign-2-codes/GAME_TRY/MY_GAME/FINAL_GAME/S20180010067_AI_Assign-2
12:05 PM
8). Place X at (3,0)
9). Place X at (3,1)
10). Place X at (3,4)
11). Place X at (3,5)
12). Place X at (4,0)
13). Place X at (4,1)
14). Place X at (4,2)
15). Place X at (4,3)
16). Place X at (4,4)
17). Place X at (4,5)
18). Place X at (5,0)
19). Place X at (5,1)
20). Place X at (5,2)
21). Place X at (5,3)
22). Place X at (5,4)
23). Place X at (5,5)
Enter action index:0

Game state is:
['X', 'X', 'X', 'O', 'X', 'X']
['X', 'X', '-', '-', '-', '-']
['-', '-', 'O', 'O', 'O', '-']
['-', '-', 'O', 'O', '-', '-']
['-', '-', '-', '-', '-', '-']
['-', '-', '-', '-', '-', '-']
Its my turn:
I will do:Place O at (4,2)
Time taken by Game playing agent in seconds for a move: 0.4980940818786621

```
isha16@isha16-VirtualBox: ~/AI_SEM-4/AI_Assign-2-codes/GAME_TRY/MY_GAME/FINAL_GAME/S20180010067_AI_Assign-2    12:06 PM
****************************************************************************************

Game state is:
['X', 'X', 'X', 'O', 'X', 'X']
['X', 'X', '-', '-', '-', '-']
['-', '-', 'O', 'O', 'O', '-']
['-', '-', 'O', 'O', '-', '-']
['-', '-', 'O', '-', '-', '-']
['-', '-', '-', '-', '-', '-']

Its your turn:
 Legal actions:
0). Place X at (1,2)
1). Place X at (1,3)
2). Place X at (1,4)
3). Place X at (1,5)
4). Place X at (2,0)
5). Place X at (2,1)
6). Place X at (2,5)
7). Place X at (3,0)
8). Place X at (3,1)
9). Place X at (3,4)
10). Place X at (3,5)
11). Place X at (4,0)
12). Place X at (4,1)
13). Place X at (4,3)
14). Place X at (4,4)
15). Place X at (4,5)
16). Place X at (5,0)
17). Place X at (5,1)
18). Place X at (5,2)
19). Place X at (5,3)
20). Place X at (5,4)
21). Place X at (5,5)
Enter action index:1
```

```
isha16@isha16-VirtualBox: ~/AI_SEM-4/AI_Assign-2-codes/GAME_TRY/MY_GAME/FINAL_GAME/S20180010067_AI_Assign-2    12:06 PM
20). Place X at (5,4)
21). Place X at (5,5)
Enter action index:1

-------------------------------------------------------------------------------------



Game state is:
['X', 'X', 'X', 'O', 'X', 'X']
['X', 'X', '-', 'X', '-', '-']
['-', '-', 'O', 'O', 'O', '-']
['-', '-', 'O', 'O', '-', '-']
['-', '-', 'O', '-', '-', '-']
['-', '-', '-', '-', '-', '-']

Its my turn:
I will do:Place O at (1,2)
Time taken by Game playing agent in seconds for a move: 0.45934462547302246

****************************************************************************************

!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

The terminal GameState is:
['X', 'X', 'X', 'O', 'X', 'X']
['X', 'X', 'O', 'X', '-', '-']
['-', '-', 'O', 'O', 'O', '-']
['-', '-', 'O', 'O', '-', '-']
['-', '-', 'O', '-', '-', '-']
['-', '-', '-', '-', '-', '-']

AI wins
```