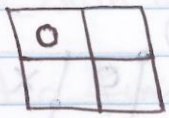
AI Assignment #1

① question 1 (part 1) :

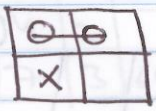
Start state:



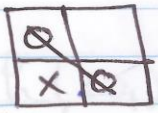
due to symmetry there will be one start state

end states:

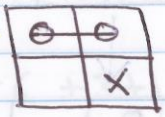
(a)



(c)

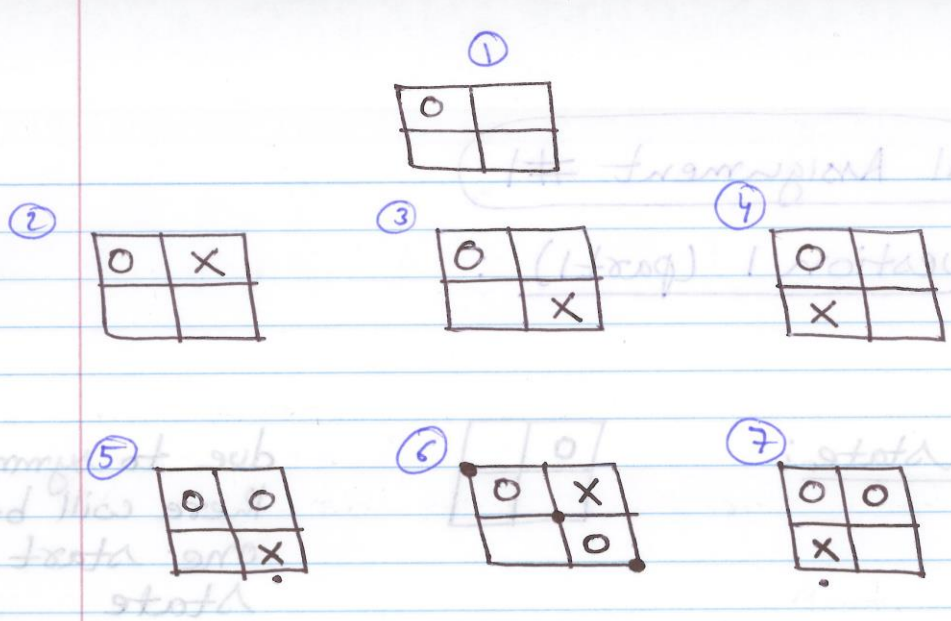


(b)

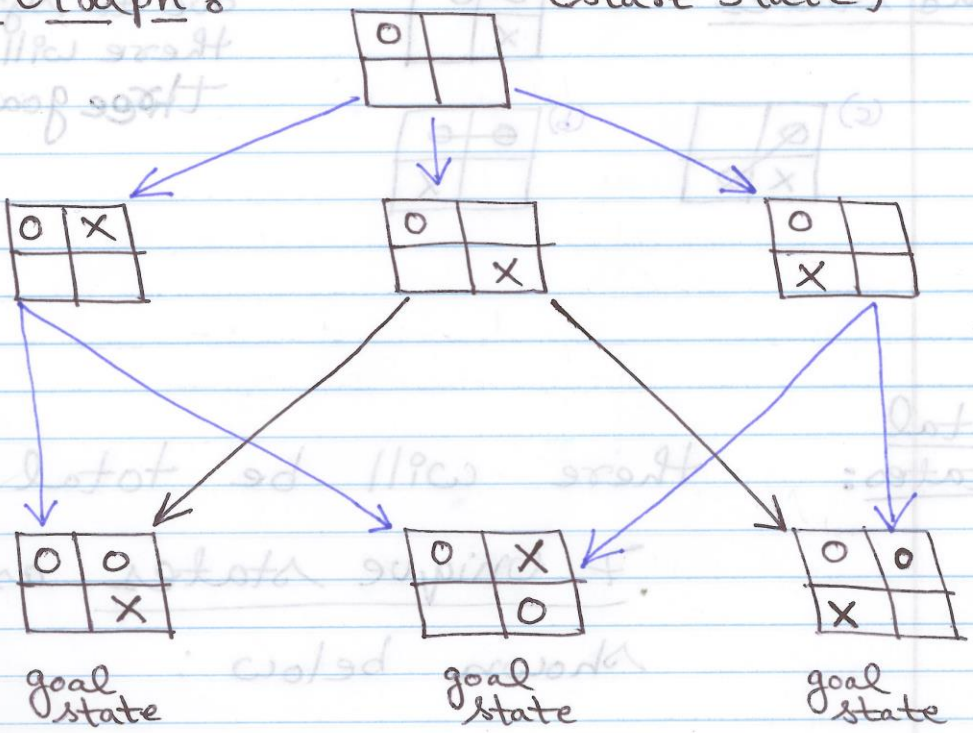


due to symmetry there will be three goal states

Total states: there will be total of 7 unique states as shown below :



State Graph:



AI Assignment #1

② question 2 (Part 1): → (P.I. Value)

Given: $h(s)$ = (sum of permutation inversions) is a heuristic function for 8-Puzzle problem.

Assumption:

Example –

5		8
4	2	1
7	3	6

State (N_1)

1	2	3
4	5	6
7	8	

State (GOAL)

$h(N_1) = (4+6+3+1+0+2+0+0) = 16$

To Prove: If $h(s)$ is an admissible heuristic function.

Proof:

We define an admissible heuristic function $h(s)$ like this –

"Let $h^*(N)$ be the cost of the optimal path from N^{th} state to a goal node.

Let $h(N)$ be a heuristic function.

$h(N)$ is admissible if and only if

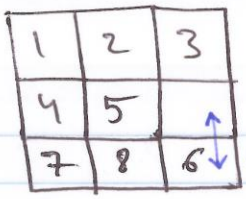
$$\boxed{0 \leqslant h(N) \leqslant h^*(N)}$$

which means $h(N)$ for each state generated should show lower bound cost for state 'N' (from which goal state is reachable, which at the same time forms an optimal path to the goal node).

If there exists a scenario where $h^*(N) < h(N)$ then $h(N)$ is not admissible.

For this 8-puzzle problem, $h(s)$ function is not admissible. See the example scenario below:

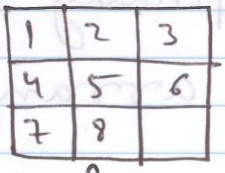
$h(s) = (P.I.\ Value)$



(state (N_0))

$h(N_0) = (1+1) = 2$

(path cost = 1)



Goal state

$h^*(N_0) = 1$

Hence we see that

$$\boxed{h^*(N_0) < h(N_0)}$$

which means $h(s) = (\text{Sum of Permutation inversions})$

is not an admissible function.