Class: B.E (Computer), Sem – VI Subject Name: Artificial Intelligence Student Name:

Roll No: 9526 Name: Pushpendersingh Bisht

Practical No:	**1**
Title:	Tic Tac Toe game implementation by a) Brute Force Method b) Heuristic Approach
Date of Performance:	**03-02-2024**
Date of Submission:	**04-02-2024**

Rubrics for Evaluation:

Sr. No	Performance Indicator	Excellent	Good	Below Average	Marks
1	On time Completion & Submission (01)	01 (On Time)	NA	00 (Not on Time)	
2	Logic/Algorithm Complexity analysis (03)	03(Correct)	02(Partial)	01 (Tried)	
3	Coding Standards (03): Comments/indention/Naming conventions Test Cases /Output	03(All used)	02 (Partial)	01 (rarely followed)	
4	Post Lab Assignment (03)	03(done well)	2 (Partially Correct)	1(submitted)	
Total					

Signature of the Teacher:

Experiment No: 1

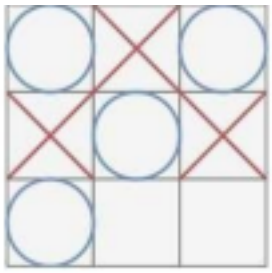
Title: Tic Tac Toe game implementation by

a) Brute Force Method

b) Heuristic Approach

Objective: To write a computer program in such a way that computer wins most of the time **Theory:**

This is a 2 players game where each player should put a cross or a circle on a 3 x 3 grid. The first player that has 3 crosses or 3 circles aligned (be it vertically, horizontally or diagonally) wins the game.



The blue player won because he aligned 3 blue circles on the diagonal

a) Brute Force Method

A brute force approach is an approach that finds all the possible solutions to find a satisfactory solution to a given problem. The brute force algorithm tries out all the possibilities till a satisfactory solution is not found.

a) Consider a Board having nine element vectors.

b) Each element will contain

i) 0 for blank

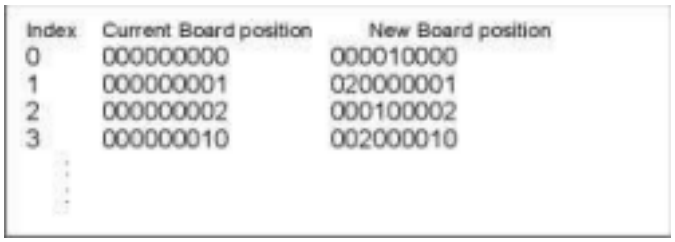
ii) 1 indicating 'X' player move

iii) 2 indicating 'O' player move

c) Computer may play as an 'X' or O player.

d) First player always plays as 'X'.

2) MT is a vector of 3^9elements, each element of which is a nine-element vector representing board position.
3) MT is a vector of 3^9elements, each element of which is a nine-element vector representing board position.
   a) Move Table (MT) is a vector of 39 elements, each element of which is a nine element vector representing board position.



Index	Current Board position	New Board position
0	000000000	000010000
1	000000001	020000001
2	000000002	000100002
3	000000010	002000010
⋮		

   b) To make a move, do the following:

      a. View the vector (board) as a ternary number and convert it to its corresponding decimal number.

      b. Use the computed number as an index into the MT and access the vector stored there.

         i. The selected vector represents the way the board will look after the move.

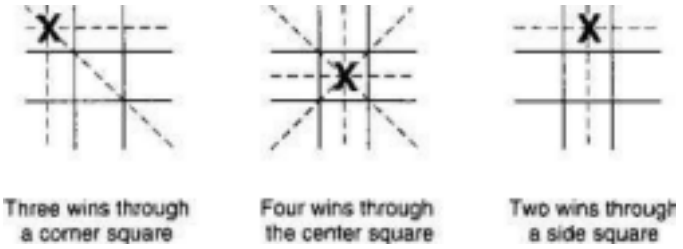
      c. Set board equal to that vector.

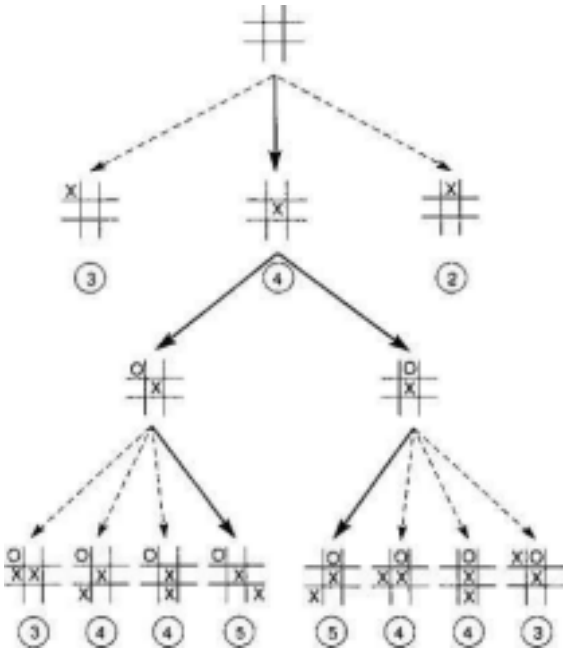
b) Heuristic Approach

Heuristics are essentially problem-solving tools that can be used for solving non-routine and challenging problems. A heuristic method is a practical approach for a short-term goal, such as solving a problem. The approach might not be perfect but can help find a quick solution to help move towards a reasonable way to resolve a problem.

Without considering symmetry the search space is 9! using symmetry the search space is 12 * 7! A simple heuristic isthe number ofsolution pathsstill open when there are 8 total

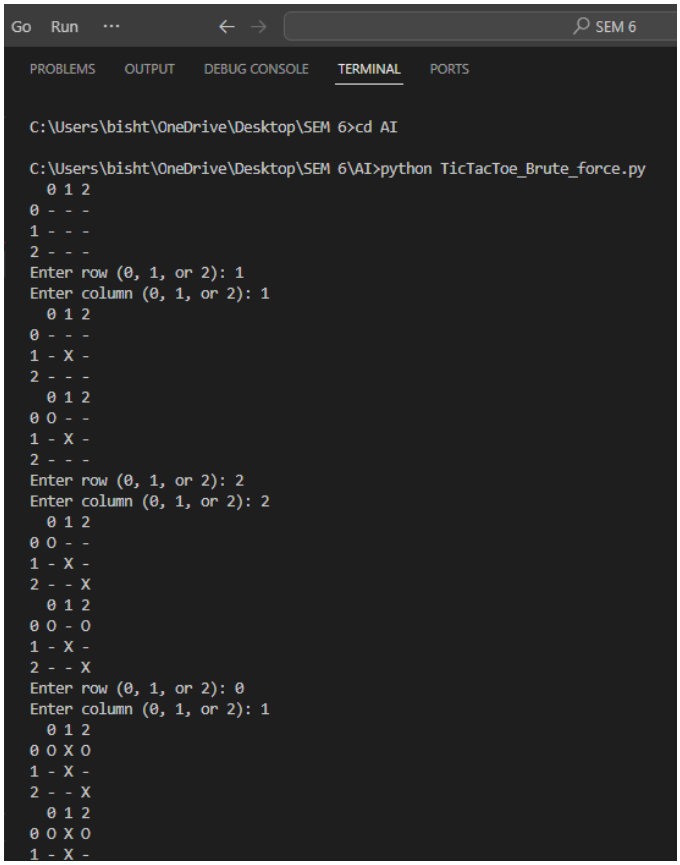
paths (3 rows, 3 columns, 2 diagonals). Here is the search space using this heuristic. The total search space is now reduced to about 40, depending on the opponents play.

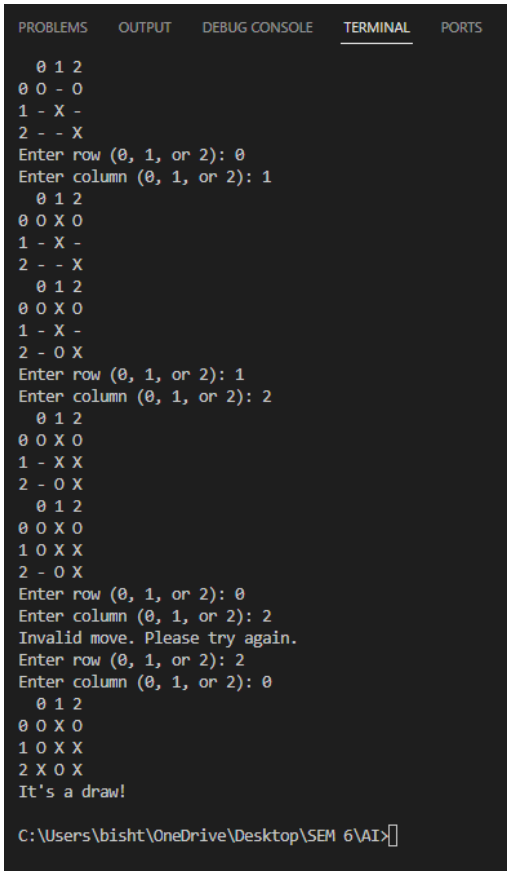




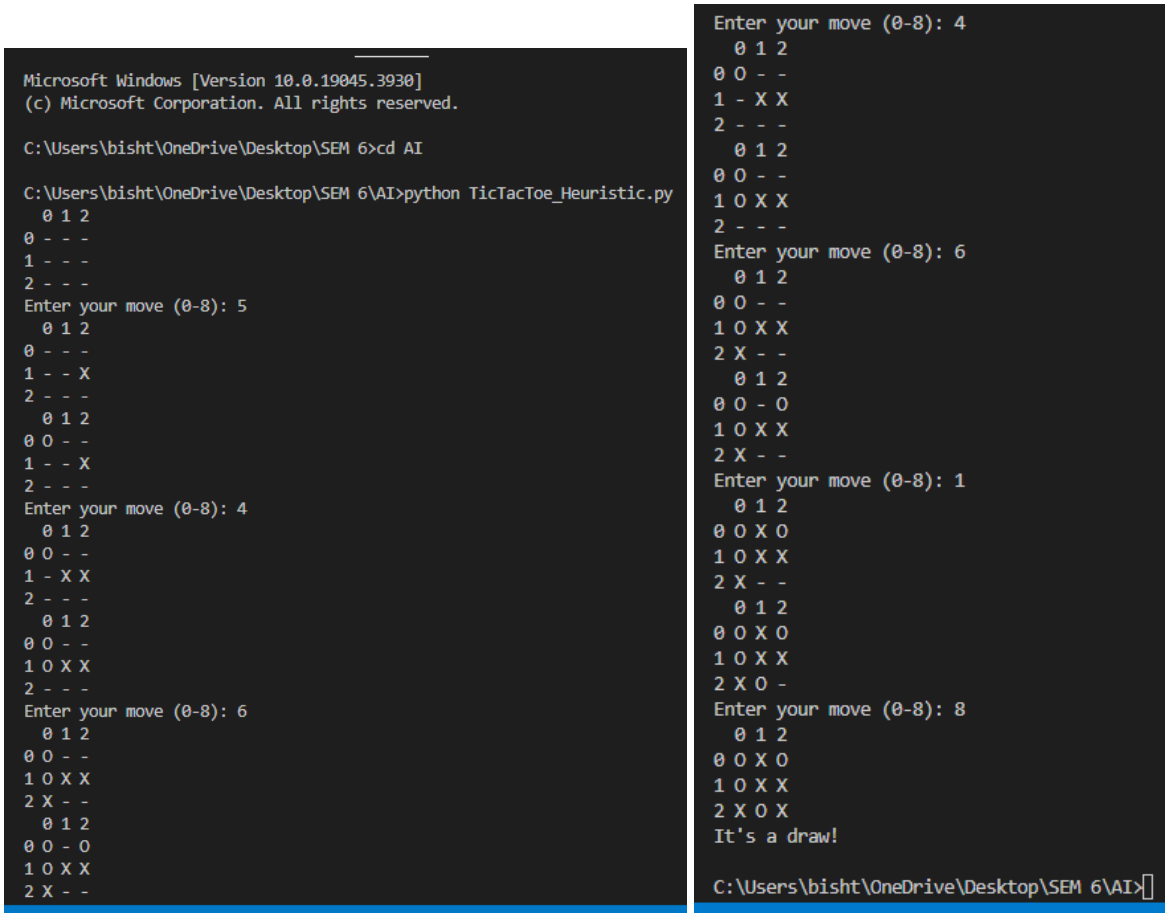
OUTPUT:

BRUTE FORCE METHOD:





HEURISTIC METHOD:



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Microsoft Windows [Version 10.0.19045.3930]
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C:\Users\bisht\OneDrive\Desktop\SEM 6>cd AI

C:\Users\bisht\OneDrive\Desktop\SEM 6\AI>python TicTacToe_Heuristic.py
  0 1 2
0 - - -
1 - - -
2 - - -
Enter your move (0-8): 5
  0 1 2
0 - - -
1 - - X
2 - - -
  0 1 2
0 O - -
1 - - X
2 - - -
Enter your move (0-8): 4
  0 1 2
0 O - -
1 - X X
2 - - -
  0 1 2
0 O - -
1 O X X
2 - - -
Enter your move (0-8): 6
  0 1 2
0 O - -
1 O X X
2 X - -
  0 1 2
0 O - O
1 O X X
2 X - -
Enter your move (0-8): 4
  0 1 2
0 O - -
1 - X X
2 - - -
  0 1 2
0 O - -
1 O X X
2 - - -
Enter your move (0-8): 6
  0 1 2
0 O - -
1 O X X
2 X - -
  0 1 2
0 O - O
1 O X X
2 X - -
Enter your move (0-8): 1
  0 1 2
0 O X O
1 O X X
2 X - -
  0 1 2
0 O X O
1 O X X
2 X O -
Enter your move (0-8): 8
  0 1 2
0 O X O
1 O X X
2 X O X
It's a draw!

C:\Users\bisht\OneDrive\Desktop\SEM 6\AI>
```

Post Lab Assignment:

1. What is the easiest trick to win Tic Tac Toe?
2. What is the algorithm to follow to win a 5*5 Tic Tac Toe?
3. Is there a way to never lose at Tic-Tac-Toe?
4. What can tic-tac-toe help you with?

Q. No. | No.

Pushpendersingh Bisht 9526 TE COMPS A

Post Lab Assignment: Experiment - 1

1] What is the easiest trick to win Tic Tac Toe?

⇒ The easiest trick to win Tic-Tac-Toe is as follows:

1. Start by placing your first mark in the center square.
2. If your opponent doesn't place their mark in a ~~corner~~ corner square, place your second mark in any corner
3. Otherwise, place your second mark in a corner opposite to your first mark.
4. From your third move onwards, prioritize completing rows, columns or diagonals while blocking your opponent's moves.

2] What is the algorithm to follow to win a 5X5 Tic Tac Toe?

⇒ Algorithms:

1. Control the center square.
2. Create two-in-a-row, three-in-a-row or four-in-a-row combination horizontally, vertically or diagonally
3. Secure adjacent corner square to create multiple winning paths
4. Control edge squares to add flexibility to winning combinations and block opponent's moves.
5. Anticipate opponents moves and block potential winning moves while advancing your own strategy.
6. Be flexible and adapt strategy based on the current state of the board and opponent's moves.

3] Is there a way to never lose at Tic-Tac-Toe?

=> 1. Start in the center: Always begin with the center square for more winning opportunities and board control.
2. Create and block: Priortize forming winning combinations while blocking your opponent's moves to maintain control and increase your chances of winning.
3. Adapt strategy: Adjust your approach based on the boards state and opponents moves to stay ahead and maximize your winning potential.

4] What can tic-tac-toe help you with?

=> 1. Strategic Thinking: Planning and executing moves to outmaneover your opponent.
2. Problem-Solving: Analyzing the game state and finding optimal moves to achieve victory.
3. Pattern Recognition: Identifying pattern and potential winning combinations on board.
4. Score good grade: Studying tic-tac-toe will helps to gain marks in AI
5. Decision-Making: Evaluating different options and selecting the best course of action.
6. Critical Thinking: Accessing the consequences of each move and predicting ~~your~~ your opponent's responses.