Fr. Conceicao Rodrigues College of Engineering
Fr. Agnel Ashram, Bandstand, Bandra (W), Mumbai - 400050

Department of Computer Engineering
Academic Term II: 23-24

Class: B.E (Computer), Sem – VI **Subject Name: Artificial Intelligence**
Student Name: Siddhesh Pradhan **Roll No: 9632**

Practical No:	**2**
Title:	Tic Tac Toe game implementation by Magic Square Method
Date of Performance:	29/01/2024
Date of Submission:	13/02/2024

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:

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Experiment No: 2

Title: Tic Tac Toe game implementation by Magic Square Method

Objective: To write a computer program in such a way that computer wins most of the time using Magic Square Method

Theory:

A player who places his coins first across the same row or same column or same diagonal wins the game. Let us take a magic square of order 3 x 3 (for 3 coins game). The sum of the numbers across rows, columns and diagonals are the same - it is 15. That is, a player who places his coins such that he gets the perfect score of 15 takes the prize.

1) Board is considered to be a magic square of size 3 X 3 with 9 blocks numbered by numbers indicated by the magic square.
2) This representation makes the process of checking for a possible win simpler. Board Layout as magic square. Each row, column and diagonals add to 15.

8	3	4	**15**
1	5	9	**15**
6	7	2	**15**

3) Maintain the list of each player's blocks in which he has played.
   Consider each pair of blocks that the player owns.

Compute difference D between 15 and the sum of the two blocks.
If D < 0 or D > 9 then

i) These two blocks are not collinear and so can be ignored.

ii)Otherwise, if the block representing difference is blank (i.e., not in either list) then a move in that block will produce a win.

OUTPUT:-

expt2.py

```
# Program for Tic-Tac-Toe using MagicSquare Method

import random

def print_board(board):
    for row in board:
        print(" | ".join(row))
        print("-" * 13)

def is_winner(board, player):
    for row in board:
        if all(cell == player for cell in row):
            return True

    for col in range(3):
        if all(board[row][col] == player for row in range(3)):
            return True

    if all(board[i][i] == player for i in range(3)) or all(board[i][2 - i] == player
for i in range(3)):
        return True

    return False

def is_board_full(board):
    return all(cell != ' ' for row in board for cell in row)

def get_user_move():
    while True:
```

```
try:
            move = int(input("Enter your move (1-9): "))
            if 1 <= move <= 9:
                return move
            else:
                print("Invalid move. Please enter a number between 1 and 9.")
        except ValueError:
            print("Invalid input. Please enter a number.")

def calculate_computer_move(board, player_symbol, computer_symbol):
    magic_square = [
        [8, 3, 4],
        [1, 5, 9],
        [6, 7, 2]
    ]

    empty_cells = [(i, j) for i in range(3) for j in range(3) if board[i][j] == ' ']

    for i, j in empty_cells:
        temp_board = [row[:] for row in board]
        temp_board[i][j] = computer_symbol
        if is_winner(temp_board, computer_symbol):
            return i * 3 + j + 1

    for i, j in empty_cells:
        temp_board = [row[:] for row in board]
        temp_board[i][j] = player_symbol
        if is_winner(temp_board, player_symbol):
            return i * 3 + j + 1

    return random.choice(empty_cells)[0] * 3 + random.choice(empty_cells)[1] + 1

def play_tic_tac_toe():
    board = [[' ' for _ in range(3)] for _ in range(3)]
    user_symbol, computer_symbol = 'X', 'O'

    print("Welcome to Tic-Tac-Toe using Magic Square technique!")
    print_board(board)

    for move_num in range(1, 10):
        current_player = user_symbol if move_num % 2 == 1 else computer_symbol
```

```
if current_player == user_symbol:
            user_move = get_user_move()



row, col = divmod(user_move - 1, 3)
        else:
            computer_move = calculate_computer_move(board, user_symbol,
computer_symbol)
            row, col = divmod(computer_move - 1, 3)
            print(f"Computer chooses position {computer_move}")

        while board[row][col] != ' ':
            print("ERROR! That position is already taken. Choose a different one.")
            if current_player == user_symbol:
                user_move = get_user_move()
                row, col = divmod(user_move - 1, 3)
            else:
                computer_move = calculate_computer_move(board, user_symbol,
computer_symbol)
                row, col = divmod(computer_move - 1, 3)

        board[row][col] = user_symbol if current_player == user_symbol else
computer_symbol
        print_board(board)

        if is_winner(board, current_player):
            print(f"{current_player} wins!")
            break

        if is_board_full(board):
            print("It's a tie!")
            break


play_tic_tac_toe()
```

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```
PS C:\Local Disk D\6thSem\AI pracs> python3 expt2.py
Welcome to Tic-Tac-Toe using Magic Square technique!
  |   |
-------------
  |   |
-------------
  |   |
-------------
Enter your move (1-9): 5
  |   |
-------------
  | X |
-------------
  |   |
-------------
Computer chooses position 6
  |   |
-------------
  | X | O
-------------
  |   |
-------------
Enter your move (1-9): 7
  |   |
-------------
  | X | O
-------------
X |   |
-------------
```

```
-------------
Computer chooses position 3
  |   | O
-------------
  | X | O
-------------
X |   |
-------------
Enter your move (1-9): 9
  |   | O
-------------
  | X | O
-------------
X |   | X
-------------
Computer chooses position 1
O |   | O
-------------
  | X | O
-------------
X |   | X
-------------
Enter your move (1-9): 8
O |   | O
-------------
  | X | O
-------------
X | X | X
-------------
```

```
  |   | O
-------------
  | X | O
-------------
X |   |
-------------
Enter your move (1-9): 9
  |   | O
-------------
  | X | O
-------------
X |   | X
-------------
Computer chooses position 1
O |   | O
-------------
  | X | O
-------------
X |   | X
-------------
Enter your move (1-9): 8
O |   | O
-------------
  | X | O
-------------
X | X | X
-------------
X wins!
PS C:\Local Disk D\6thSem\AI pracs>
```

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Post Lab Assignment:

1. What is the relationship between tic-tac-toe and magic square?

Ans:- Tic-tac-toe and magic squares both involve arranging numbers or symbols in a grid, but they have different objectives and rules. Tic-tac-toe is a game where players aim to create a line of their symbols, while a magic square is a square grid where the numbers in each row, column, and diagonal add up to the same sum.

2. What is a magic square of order n?

Ans:- A magic square of order n is an arrangement of the numbers from 1 to n^2 in a square grid such that the sum of the numbers in each row, each column, and both main diagonals is the same. This sum is called the "magic constant" of the magic square.