***Flipping Tiles (memory game) using Python***

**A PROJECT REPORT**

**CSA0884 - Python Programming to Analyze Data**

**Submitted to**

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**SCIENCES**

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**BONAFIDE CERTIFICATE**

Certified that this project report titled “Flipping Tiles (memory game) using Python” is the bonafide work of “P.Jagadeesh kumar(192210348) and S.Sreedhar(192221088)” who carried out the project work under my supervision as a batch. Certified further, that to the best of my knowledge, the work reported herein does not form any other project report.

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# Head of the Department Project Supervisor ABSTRACT:

The project involves creating an interactive Flipping Tiles (Memory) game using the Python programming language. The Memory game is a classic card-matching game where players flip over two tiles at a time to find matching pairs. The objective is to match all pairs of tiles in the fewest possible moves. This project not only implements the basic game mechanics but also includes an AI opponent that can simulate a second player. The development process demonstrates the application of various programming concepts and techniques, making it an enriching learning experience.

# INTRODUCTION:

In this mini-project, we will be designing an interactive Flipping Tiles (Memory) game using Python. The primary goal is to create an engaging game where players flip tiles to find matching pairs, with an option to play against an AI opponent. This project aims to provide a practical learning experience in programming and showcase Python's capabilities in developing interactive applications. By working on this game, we will explore essential programming concepts such as data structures, loops, conditionals, and functions, while also diving into more advanced topics like graphical user interface (GUI) design and artificial intelligence.

Projects like this serve as excellent learning tools, allowing us to apply programming knowledge practically and enjoyably. Completing a project from start to finish offers a deeper understanding of programming concepts and enhances problem-solving skills. Additionally, developing a game can be both fun and fulfilling, maintaining motivation throughout the learning journey.

By creating a Flipping Tiles game, we will not only cover the basics of game development but also delve into the intricacies of game logic, user input handling, and AI design. This project will establish a solid foundation for further exploration in game development and artificial intelligence, providing a springboard for future projects and learning opportunities.

# ALGORITHM:

# Setting Up the Board

The algorithm for setting up the board involves creating a grid of tiles where each tile has a matching pair. The tiles are shuffled and placed face down on the board.

1. Define a set of matching pairs of tiles.
2. Duplicate the set to create pairs.
3. Shuffle the tiles randomly.
4. Place the shuffled tiles face down on a grid.

# Checking for a Match

To determine if two flipped tiles form a match, the algorithm compares their values. If the values match, the tiles remain face-up; otherwise, they are flipped back face down after a short delay.

1. When two tiles are flipped:
   * Compare the values of the two tiles.
2. If the values match: o Leave the tiles face-up.
3. If the values do not match:
   * Wait for a short delay. o Flip the tiles back face down.

# Handling User Inputs

The algorithm for handling user inputs ensures that the moves are valid and updates the board accordingly. It involves detecting user clicks, validating the input, and updating the game state.

1. Detect the user's click on a tile.
2. Validate the input:
   * Check if the clicked tile is face down.
   * Check if two tiles are already flipped face-up.
3. If the input is valid:
   * Flip the clicked tile face-up.
   * If two tiles are now face-up, check for a match.
4. If the input is invalid:
   * Ignore the click and wait for a valid move.

# AI Opponent Strategy

The algorithm for the AI opponent involves simulating a second player that can remember previously flipped tiles and use this memory to make informed moves.

1. Maintain a memory of previously flipped tiles and their positions.
2. When it's the AI's turn:
   * If a match is known from memory, flip those tiles.
   * If no match is known, flip a random tile.
   * Update the memory with the new tile information.
   * If a match is found, flip the matching tile.
3. Continue until all pairs are matched or the game ends.

# Overall Flow

1. Initialize the game board.
2. While not all pairs are matched:
   * Display the current state of the board.
   * If it's the human player's turn:
     + Handle user input and update the board.
   * If it's the AI's turn:
     + Determine the next move using the AI strategy and update the board.
   * Check for matches and update the game state.
3. Display the final state of the board and the result.

# Game Logic:

To integrate these components, the game logic should:  Initialize the Game Board: Set up the grid with shuffled pairs of tiles placed face down.  Player Turns: Implement a loop to alternate turns between the human player and the AI.  Move Execution: Allow the human player to input their move and update the board accordingly. For the AI, use the memory and strategy to make the best move.  Match Checking: After each move, check if the move resulted in a match or if the game is complete.  Game End: Announce the completion of the game and the number of moves taken.

# Components of the Game:

Game Board Representation Grid Size: Typically, a grid of size 4x4, 6x6, or 8x8 is used. Data Structure: A 2-dimensional list or array can represent the game board, with each cell containing a tile value or an indicator of whether it is face up or face down.  Turn-taking Logic Players: Two players alternate turns. One player can be the human, and the other can be the AI. Move Execution: On each turn, a player flips two tiles to check for a match. Turn Switching: After a player makes a move, it becomes the other player's turn.  Match Determination Match Condition: A pair of tiles is considered matched if they have the same value. Draw Condition: The game ends when all pairs are matched.

# Designing the Intelligent AI:

An AI for the Memory game needs to remember previously flipped tiles and make strategic decisions to find matching pairs. Here are key concepts involved in designing such an AI:

1. Memory Management Memory Array: Maintain an array to store the values and positions of previously flipped tiles. Match Detection: Use the memory array to detect if a previously seen tile matches the currently flipped tile.
2. Move Selection Known Matches: If a match is known from memory, flip those tiles. Random Selection: If no match is known, randomly select a tile to flip. Memory Update: After each move, update the memory with the new tile information.
3. Implementing the AI Candidate Moves: Generate a list of possible moves and evaluate them based on memory. Best Move Selection: Select the move that maximizes the chances of finding a match. Adaptability: The AI should adapt its strategy based on the current state of the game and the tiles flipped so far

**Source code:**

from random import shuffle from turtle import Screen, up, goto, down, color, begin\_fill, forward, left, end\_fill, clear, stamp, write, update, ontimer, onscreenclick, done, tracer # set the screen screen = Screen() screen.bgcolor("yellow")

def Square(x, y):

up() goto(x, y) down() color('white', 'green') begin\_fill() for count in range(4):

forward(50) left(90) end\_fill()

def Numbering(x, y):

return int((x + 200) // 50 + ((y + 200) // 50) \* 8)

def Coordinates(count):

return (count % 8) \* 50 - 200, (count // 8) \* 50 - 200

def click(x, y):

spot = Numbering(x, y) mark = state['mark']

if mark is None or mark == spot or tiles[mark] != tiles[spot]:

state['mark'] = spot else:

hide[spot] = False

hide[mark] = False state['mark'] = None

def draw(): clear() goto(0, 0) stamp()

for count in range(64): if hide[count]: x, y = Coordinates(count)

Square(x, y)

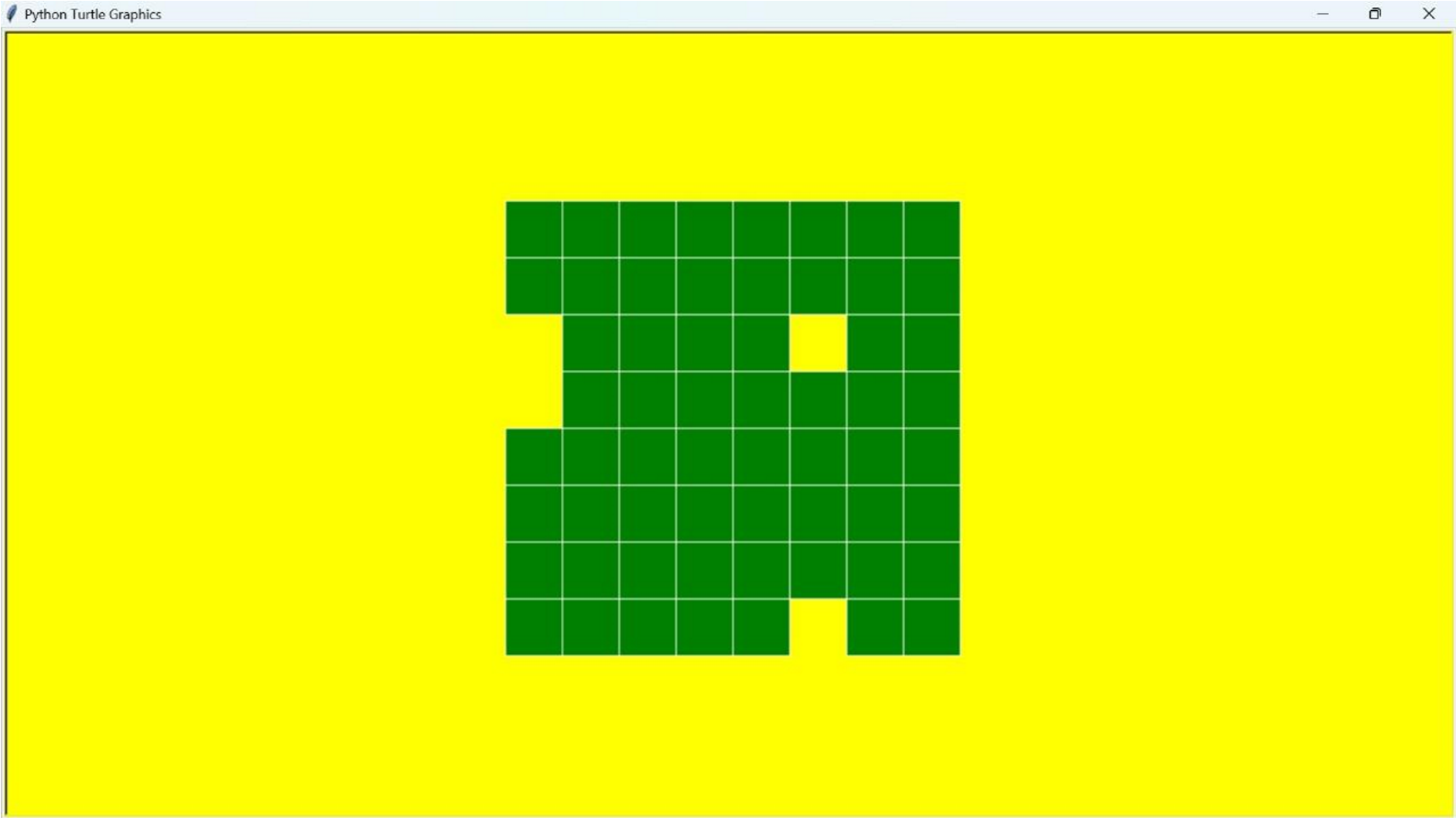
mark = state['mark']

if mark is not None and hide[mark]:

x, y = Coordinates(mark) up() goto(x + 2, y) color('black') write(tiles[mark], font=('Arial', 30, 'normal'))

update() ontimer(draw, 10)

tiles = list(range(32)) \* 2 state = {'mark': None} hide = [True] \* 64 shuffle(tiles) tracer(False) onscreenclick(click) draw() done() **source output:-**



# Results:

# Outcome of the Project

The implementation of the Flipping Tiles (Memory) game was successful and met the project objectives. The game functions as intended, allowing users to flip tiles and match pairs. Additionally, the game includes an AI opponent that simulates a second player, enhancing the interactive experience.

**Challenges Faced:** During the development process, several challenges were encountered:

* **Handling User Inputs:** Ensuring that user inputs were valid and within the range of the game board.
* **Match Logic:** Implementing the logic to check for matches and handle the flipping of tiles correctly.
* **AI Development:** Designing an AI that could effectively remember previously flipped tiles and make strategic moves was complex. Balancing the AI's memory and randomness to provide a challenging yet fair opponent was crucial.
* **Performance:** Managing the performance of the game, particularly with the AI's decision-making process, to ensure moves were made in a reasonable time frame.

**Lessons Learned:** Through this project, valuable lessons were learned in Python programming and game development:

* **Problem-Solving:** The project honed problem-solving skills, demonstrating how to break down complex problems into smaller, manageable tasks.
* **Testing and Error Handling:** Emphasized the importance of thorough testing and error handling to ensure the game's robustness.
* **AI Techniques:** Gained insights into AI techniques and algorithms, such as memory management and heuristics, which can be applied to other game development projects.

**Functionality and User Experience:** The Flipping Tiles game provides a smooth and intuitive user experience:

* **User Interaction:** Players can easily make their moves by clicking on the tiles to flip them.
* **Game Progress:** The game board is displayed after each move, allowing players to track the progress of the game.
* **AI Interaction:** When playing against the AI, the AI's moves are made quickly and strategically, providing a challenging opponent.

# Future Enhancements: Graphical User Interface (GUI)

* **Objective:** Enhance the game's visual appeal and user experience.
* **Implementation:** Use libraries like Tkinter or Pygame to create a graphical interface with clickable tiles. This will make the game more engaging and accessible, especially for users who prefer graphical interactions over text-based inputs.

# Player vs. Computer with Advanced AI

* **Objective:** Increase the game's challenge and replayability by implementing a more sophisticated AI opponent.
* **Implementation:** Develop a computer opponent with varying levels of difficulty. Start with a simple algorithm and gradually increase its intelligence using techniques like improved memory management and strategic planning. This will cater to players of different skill levels and keep the game interesting.

# Multiplayer Networked Game

* **Objective:** Transform the game into a multiplayer experience, allowing players to connect and play against each other remotely.
* **Implementation:** Implement a server-client architecture to facilitate gameplay between two remote players. This can be done using networking libraries such as socket in Python. A multiplayer mode will expand the game's reach and allow players to enjoy the game with friends or other online players.

# Conclusion: Programming Proficiency

The project to create a Flipping Tiles (Memory) game in Python has been a significant learning experience, greatly enhancing our programming skills. Through this project, we have deepened our understanding of fundamental programming concepts, including data structures, loops, and conditional statements. The complexity of the Memory game compared to simpler games has also allowed us to delve into more advanced topics such as algorithm design, recursion, and performance optimization. We have further honed our problem-solving abilities, ensuring we can write clean, efficient, and robust code.

# Practical Implementation

Mini-projects like the Flipping Tiles game are invaluable for learning and practicing programming skills. They provide a platform to apply theoretical knowledge in a practical setting, bridging the gap between classroom learning and real-world applications. By working on this project, we have experienced firsthand how abstract concepts translate into functional software. This practical implementation fosters creativity and encourages critical thinking, as we must devise innovative solutions to overcome challenges and achieve the desired outcomes.

# Software Development

Reflecting on the experience of creating the Flipping Tiles game, we can appreciate the vital role of planning and organization in software development. The complexity of the game required us to break down the problem into manageable tasks, allowing us to tackle each aspect systematically. This structured approach was crucial for building a functional and user-friendly game.

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