Maze Game

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from PIL import Image, ImageDrawA
import matplotlib.pyplot as plt
import numpy as np  # <-- fixed import
# Node class
class Node():
    def __init__(self, state, parent, action):  # <-- fixed
constructor
        self.state = state
        self.parent = parent
        self.action = action
# StackFrontier class (DFS)
class StackFrontier():
    def __init__(self):  # <-- fixed constructor
        self.frontier = []
    def add(self, node):
        self.frontier.append(node)
    def contains_state(self, state):
        return any(node.state == state for node in self.frontier)
    def empty(self):
        return len(self.frontier) == 0
    def remove(self):
        if self.empty():
            raise Exception("empty frontier")
        else:
            node = self.frontier[-1]
            self.frontier = self.frontier[:-1]
            return node
# QueueFrontier class (BFS)
class QueueFrontier(StackFrontier):
    def remove(self):
        if self.empty():
            raise Exception("empty frontier")
        else:
            node = self.frontier[0]
            self.frontier = self.frontier[1:]
            return node
# Maze class
class Maze():
    def __init__(self, filename):  # <-- fixed constructor
        # Read file and set height and width of maze
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        with open(filename) as f:
            contents = f.read()
        # Validate start and goal
        if contents.count("A") != 1:
            raise Exception("Maze must have exactly one start point
'A'")
        if contents.count("B") != 1:
            raise Exception("Maze must have exactly one goal point
'B'")
        # Determine height and width of maze
        contents = contents.splitlines()
        self.height = len(contents)
        self.width = max(len(line) for line in contents)
        # Keep track of walls
        self.walls = []
        for i in range(self.height):
            row = []
            for j in range(self.width):
                try:
                    if contents[i][j] == "A":
                        self.start = (i, j)
                        row.append(False)
                    elif contents[i][j] == "B":
                        self.goal = (i, j)
                        row.append(False)
                    elif contents[i][j] == " ":
                        row.append(False)
                    else:
                        row.append(True)
                except IndexError:
                    row.append(False)
            self.walls.append(row)

        self.solution = None

    def print(self):
        solution = self.solution[1] if self.solution is not None else
None
        print()
        for i, row in enumerate(self.walls):
            for j, col in enumerate(row):
                if col:
                    print("\u2588", end="")
                elif (i, j) == self.start:
                    print("A", end="")
                elif (i, j) == self.goal:
                    print("B", end="")
                elif solution is not None and (i, j) in solution:
                    print("*", end="")
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                else:
                    print(" ", end="")
            print()
        print()

    def neighbors(self, state):
        row, col = state
        candidates = [
            ("up", (row - 1, col)),
            ("down", (row + 1, col)),
            ("left", (row, col - 1)),
            ("right", (row, col + 1))
        ]
        result = []
        for action, (r, c) in candidates:
            if 0 <= r < self.height and 0 <= c < self.width and not
self.walls[r][c]:
                result.append((action, (r, c)))
        return result
    def solve(self):
        """Finds a solution to maze, if one exists."""
        self.num_explored = 0
        start = Node(state=self.start, parent=None, action=None)
        # Use BFS or DFS
        # frontier = StackFrontier()  # DFS
        frontier = QueueFrontier()   # BFS
        frontier.add(start)
        self.explored = set()
        while True:
            if frontier.empty():
                raise Exception("no solution")
            node = frontier.remove()
            self.num_explored += 1
            if node.state == self.goal:
                actions = []
                cells = []
                # Backtrack
                while node.parent is not None:
                    actions.append(node.action)
                    cells.append(node.state)
                    node = node.parentz
                actions.reverse()
                cells.reverse()
                self.solution = (actions, cells)
                return
            self.explored.add(node.state)
            for action, state in self.neighbors(node.state):
                if not frontier.contains_state(state) and state not in
self.explored:
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                    child = Node(state=state, parent=node,
action=action)
                    frontier.add(child)
    def output_image(self, filename, show_solution=True,
show_explored=False):
        cell_size = 50
        cell_border = 2
        img = Image.new(
            "RGBA",
            (self.width * cell_size, self.height * cell_size),
            "black"
        )
        draw = ImageDraw.Draw(img)
        solution = self.solution[1] if self.solution is not None else
None
        for i, row in enumerate(self.walls):
            for j, col in enumerate(row):
               if col:
                    fill = (40, 40, 40)
                elif (i, j) == self.start:
                    fill = (255, 0, 0)
                elif (i, j) == self.goal:
                    fill = (0, 171, 28)
                elif solution is not None and show_solution and (i, j)
in solution:
                    fill = (220, 235, 113)
                elif solution is not None and show_explored and (i, j)
in self.explored:
                    fill = (212, 97, 85)
                else:
                    fill = (237, 240, 252)

                draw.rectangle(
                    ([(j * cell_size + cell_border, i * cell_size +
cell_border),
                      ((j + 1) * cell_size - cell_border, (i + 1) *
cell_size - cell_border)]),
                    fill=fill
                )
        img.save(filename)

# Create a maze file
maze_text = """##########
#A       #
# ####### #
#         #
# ####### #
#         #
# ####### #
#       B#
```

```
##########"""
with open("maze.txt", "w") as f:
    f.write(maze_text)
# Run the maze solver
m = Maze("maze.txt")
print("Maze:")
m.print()
print("Solving...")
m.solve()
print("States Explored:", m.num_explored)
print("Solution:")
m.print()
# Save and show the image
m.output_image("maze_solution.png", show_explored=True)
plt.figure(figsize=(10, 10))
plt.imshow(np.array(Image.open("maze_solution.png")))
plt.axis('off')
plt.title("Maze Solution")
plt.show()
```

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Maze:
```

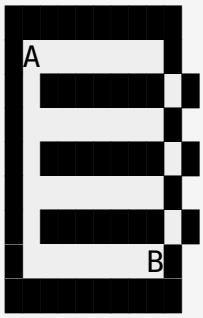


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Solving...
States Explored: 35
Solution:
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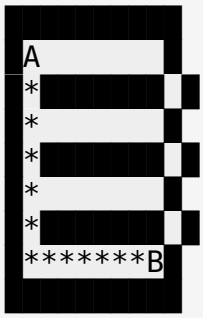

Maze Solution