

Juego del 8 BFS

Trabajo Corte 1 - Computación 2

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Fecha: Marzo 2025

El juego del ocho es un rompecabezas deslizante que consiste en una cuadrícula de 3x3 donde se encuentran 8 fichas numeradas y una casilla vacía. El objetivo es mover las fichas, deslizando aquellas que se encuentran en la misma fila o columna que la casilla vacía, hasta ordenar los números de forma secuencial (de izquierda a derecha y de arriba hacia abajo), dejando la casilla vacía en la última posición.

El código se realizó en Python utilizando conceptos básicos de programación orientada a objetos. Se creó una clase llamada **Game** que:

- Inicializa el tablero con una matriz 3x3.
- Define métodos para visualizar el tablero usando **matplotlib**.
- Implementa funciones para encontrar la casilla vacía y validar si los movimientos (arriba, abajo, izquierda o derecha) son permitidos.
- Permite realizar los movimientos actualizando el estado del tablero y registra el historial de movimientos.

Esta estructura modular facilita la extensión y mejora del código, permitiendo una gestión clara de la lógica del juego y su visualización gráfica.

```
import random
import numpy as np
import matplotlib.pyplot as plt
import datetime
from collections import deque

class Position:
    def __init__(self, x, y):
        self.x = x
        self.y = y

    def __str__(self):
        return f"x:{self.x}, y:{self.y}"

    def __repr__(self):
        return f"x:{self.x}, y:{self.y}"

class Node:
    def __init__(self, stage, move):
        self.stage = stage
```

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        self.move = move
        self.deep = None
    def __str__(self):
        return f"[move: {self.move}, stage: {self.stage}, deep: {self.deep}]"

    def __repr__(self):
        return f"[move: {self.move}, stage: {self.stage}, deep: {self.deep}]"

class Game:
    GOAL = [[1, 2, 3],
            [4, 5, 6],
            [7, 8, None]]

    def __init__(self, initial_board):
        self.board = initial_board
        self.position_empty_space = self.__find_empty_space_position()

    def __find_empty_space_position(self):
        for y in range(len(self.board)):
            for x in range(len(self.board[y])):
                if self.board[y][x] is None:
                    return Position(x, y)
        raise Exception("No se encontró un espacio vacío en el juego")

    def __copy(self):
        copy_board = [row[:] for row in self.board]
        return Game(copy_board)

    def show(self):
        _, ax = plt.subplots()
        img_data = np.array([[0 if x is None else x for x in row] for row in self.board])
        plt.imshow(img_data, cmap="YlGn", interpolation="nearest",
vmin=0, vmax=255)
        ax.set_xticks(np.arange(-0.5, len(self.board[0]), 1),
minor=True)
        ax.set_yticks(np.arange(-0.5, len(self.board), 1), minor=True)
        ax.grid(which="minor", color="black", linestyle="-",
linewidth=2)
        ax.set_xticks([])
        ax.set_yticks([])
        for i in range(len(self.board)):
            for j in range(len(self.board[0])):
                value = self.board[i][j]
                text = str(value) if value is not None else " "
                ax.text(j, i, text, ha='center', va='center',
fontsize=16, fontweight='bold')
        plt.show()

```

```

def is_game_win(self):
    return self.board == self.GOAL

def is_allowed_move_up(self):
    return self.position_empty_space.y > 0

def is_allowed_move_down(self):
    return self.position_empty_space.y < len(self.board) - 1

def is_allowed_move_left(self):
    return self.position_empty_space.x > 0

def is_allowed_move_right(self):
    return self.position_empty_space.x < len(self.board[0]) - 1

def move_up(self):
    self.board[self.position_empty_space.y]
[self.position_empty_space.x] = \
    self.board[self.position_empty_space.y - 1]
[self.position_empty_space.x]
    self.board[self.position_empty_space.y - 1]
[self.position_empty_space.x] = None
    self.position_empty_space.y -= 1

def move_down(self):
    self.board[self.position_empty_space.y]
[self.position_empty_space.x] = \
    self.board[self.position_empty_space.y + 1]
[self.position_empty_space.x]
    self.board[self.position_empty_space.y + 1]
[self.position_empty_space.x] = None
    self.position_empty_space.y += 1

def move_left(self):
    self.board[self.position_empty_space.y]
[self.position_empty_space.x] = \
    self.board[self.position_empty_space.y]
[self.position_empty_space.x - 1]
    self.board[self.position_empty_space.y]
[self.position_empty_space.x - 1] = None
    self.position_empty_space.x -= 1

def move_right(self):
    self.board[self.position_empty_space.y]
[self.position_empty_space.x] = \
    self.board[self.position_empty_space.y]
[self.position_empty_space.x + 1]
    self.board[self.position_empty_space.y]
[self.position_empty_space.x + 1] = None

```

```

        self.position_empty_space.x += 1

def next_allowed_moves(self):
    next_nodes = []
    if self.is_allowed_move_up():
        copy_game = self.__copy__()
        copy_game.move_up()
        next_nodes.append(Node(copy_game.board, "UP"))
    if self.is_allowed_move_down():
        copy_game = self.__copy__()
        copy_game.move_down()
        next_nodes.append(Node(copy_game.board, "DOWN"))
    if self.is_allowed_move_left():
        copy_game = self.__copy__()
        copy_game.move_left()
        next_nodes.append(Node(copy_game.board, "LEFT"))
    if self.is_allowed_move_right():
        copy_game = self.__copy__()
        copy_game.move_right()
        next_nodes.append(Node(copy_game.board, "RIGHT"))
    return next_nodes

first_time = datetime.datetime.now()

def bfs_solve(game):
    visited = set()
    queue = deque()
    queue.append((game, []))
    visited.add(str(game.board))

    while queue:
        current_game, path = queue.popleft()
        if current_game.is_game_win():
            return path
        for node in current_game.next_allowed_moves():
            if str(node.stage) in visited:
                continue
            visited.add(str(node.stage))
            new_game = Game(node.stage)
            new_path = path + [node.move]
            queue.append((new_game, new_path))
    return None

initial_board = [
    [None, 8, 7],
    [5, 4, 6],
    [3, 2, 1]
]

game = Game(initial_board)

```

```

print("Tablero inicial:")
game.show()

solution_moves = bfs_solve(game)

if solution_moves is not None:
    print("\nSecuencia de movimientos para alcanzar el GOAL:")
    for move in solution_moves:
        print(move)
else:
    print("No se encontró solución dentro de la profundidad máxima especificada.")

later_time = datetime.datetime.now()

print(f"El tiempo de ejecución usando BFS: {later_time - first_time}")
print("La cantidad de movimientos sugeridos usando BFS es:",
len(solution_moves))

```

Tablero inicial:

	8	7
5	4	6
3	2	1

Secuencia de movimientos para alcanzar el GOAL:

```

DOWN
DOWN
RIGHT

```

UP
LEFT
DOWN
RIGHT
RIGHT
UP
UP
LEFT
DOWN
DOWN
RIGHT
UP
UP
LEFT
DOWN
DOWN
RIGHT
UP
LEFT
LEFT
UP
RIGHT
DOWN
LEFT
DOWN
RIGHT
RIGHT

El tiempo de ejecución usando BFS: 0:01:25.665047

La cantidad de movimientos sugeridos usando BFS es: 30