REPORT FILE

8 PUZZEL SOLVER

INFORMATION

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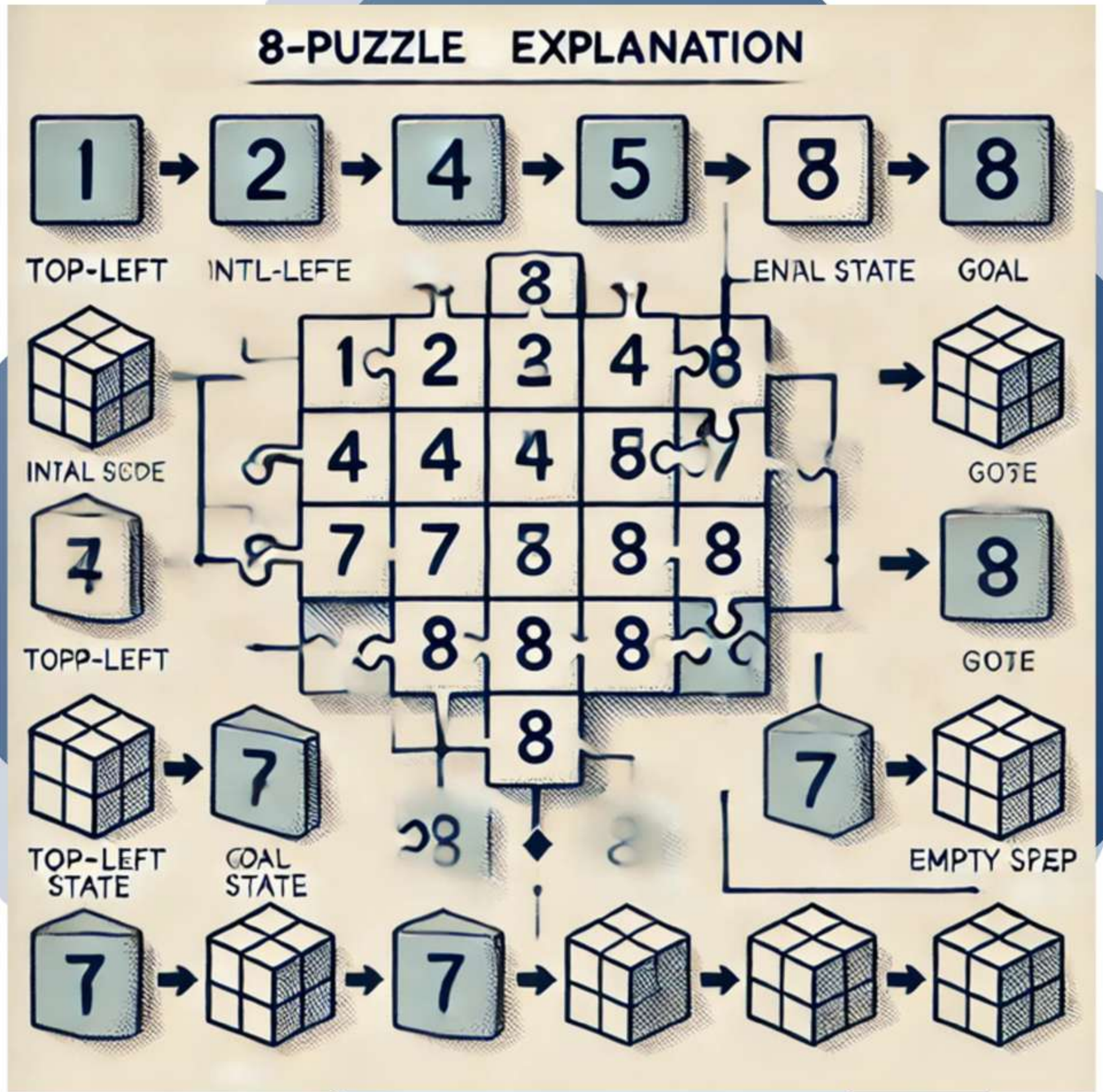
INTRODUCTION

The 8-puzzle is a sliding puzzle where tiles are arranged in order by moving them into an empty space. AI techniques like A* efficiently solve it by finding the shortest solution.



Back to Agenda

Approach to Solve

The 8-puzzle is solved using search algorithms. Uninformed methods like BFS and DFS explore blindly, while informed methods like A* use heuristics (misplaced tiles, Manhattan distance) to find efficient solutions. Other approaches include Greedy Best-First Search, IDA*, and AI techniques like genetic algorithms or reinforcement learning for optimization.

```
import heapq

# Define the goal state of the puzzle
goal_state = (1, 2, 3, 4, 5, 6, 7, 8, 0)

# Possible moves (up, down, left, right) as (row_offset, col_offset)
MOVES = [(-1, 0), (1, 0), (0, -1), (0, 1)]

# Heuristic function: Manhattan Distance
def manhattan_distance(state):
  distance = 0
  for i in range(9):
    if state[i] != 0:
      goal_pos = goal_state.index(state[i])
      current_pos = i
      # Calculate the Manhattan distance for each tile
      distance += abs(goal_pos // 3 - current_pos // 3) + abs(goal_pos % 3 -
current_pos % 3)
  return distance
```

```python
# A* algorithm to solve the 8-puzzle
def solve_puzzle(start_state):
  # Priority Queue (min-heap) to store the states
  open_list = []
  heapq.heappush(open_list, (0 + manhattan_distance(start_state), 0, start_state, []))

  # Set to keep track of visited states
  visited = set()
  visited.add(start_state)

  while open_list:
    _, g, current_state, path = heapq.heappop(open_list)

    # If we reached the goal state
    if current_state == goal_state:
      return path

    # Find the position of 0 (empty space)
    zero_pos = current_state.index(0)

    # Generate possible moves
    for move in MOVES:
      new_zero_pos = zero_pos + move[0] * 3 + move[1]
      if 0 <= new_zero_pos < 9:
        new_state = list(current_state)
        new_state[zero_pos], new_state[new_zero_pos] = new_state[new_zero_pos], new_state[zero_pos]

        new_state_tuple = tuple(new_state)
        if new_state_tuple not in visited:
          visited.add(new_state_tuple)
          new_g = g + 1
          heapq.heappush(open_list, (new_g + manhattan_distance(new_state), new_g, new_state_tuple, path + [new_state]))

  return None
```

```
# Function to print the puzzle state
def print_puzzle(state):
  for i in range(0, 9, 3):
    print(state[i:i+3])
  print()

# Function to get user input for the start state
def get_user_input():
  print("Enter the initial state of the puzzle (9 numbers from 0 to 8, where 0 represents the empty space):")
  input_state = input("Enter the state as a single line, space-separated (e.g., '1 2 3 4 5 6 7 8 0'): ")
  state_list = list(map(int, input_state.split()))

  if len(state_list) != 9 or any(x not in range(9) for x in state_list):
    print("Invalid input! Please ensure you enter exactly 9 numbers between 0 and 8.")
    return get_user_input() # Prompt again if the input is invalid
  return tuple(state_list)
```

```python
# Main function to run the solver
if __name__ == "__main__":
  # Get user input for the start state
  start_state = get_user_input()

  print("\nStart state:")
  print_puzzle(start_state)

  # Solve the puzzle
  solution = solve_puzzle(start_state)

  if solution:
    print("\nSolution path:")
    for step in solution:
      print_puzzle(step)
  else:
    print("\nNo solution found.")
```

8 puzzel solve Output

```
Enter the initial state of the puzzle (9 numbers from 0 to 8, where 0 represents the empty space):
Enter the state as a single line, space-separated (e.g., '1 2 3 4 5 6 7 8 0'): 1 2 3 4 0 5 7 8 6

Start state:
(1, 2, 3)
(4, 0, 5)
(7, 8, 6)


Solution path:
[1, 2, 3]
[4, 5, 0]
[7, 8, 6]

[1, 2, 3]
[4, 5, 6]
[7, 8, 0]
```

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Profit			
Dividend/share			

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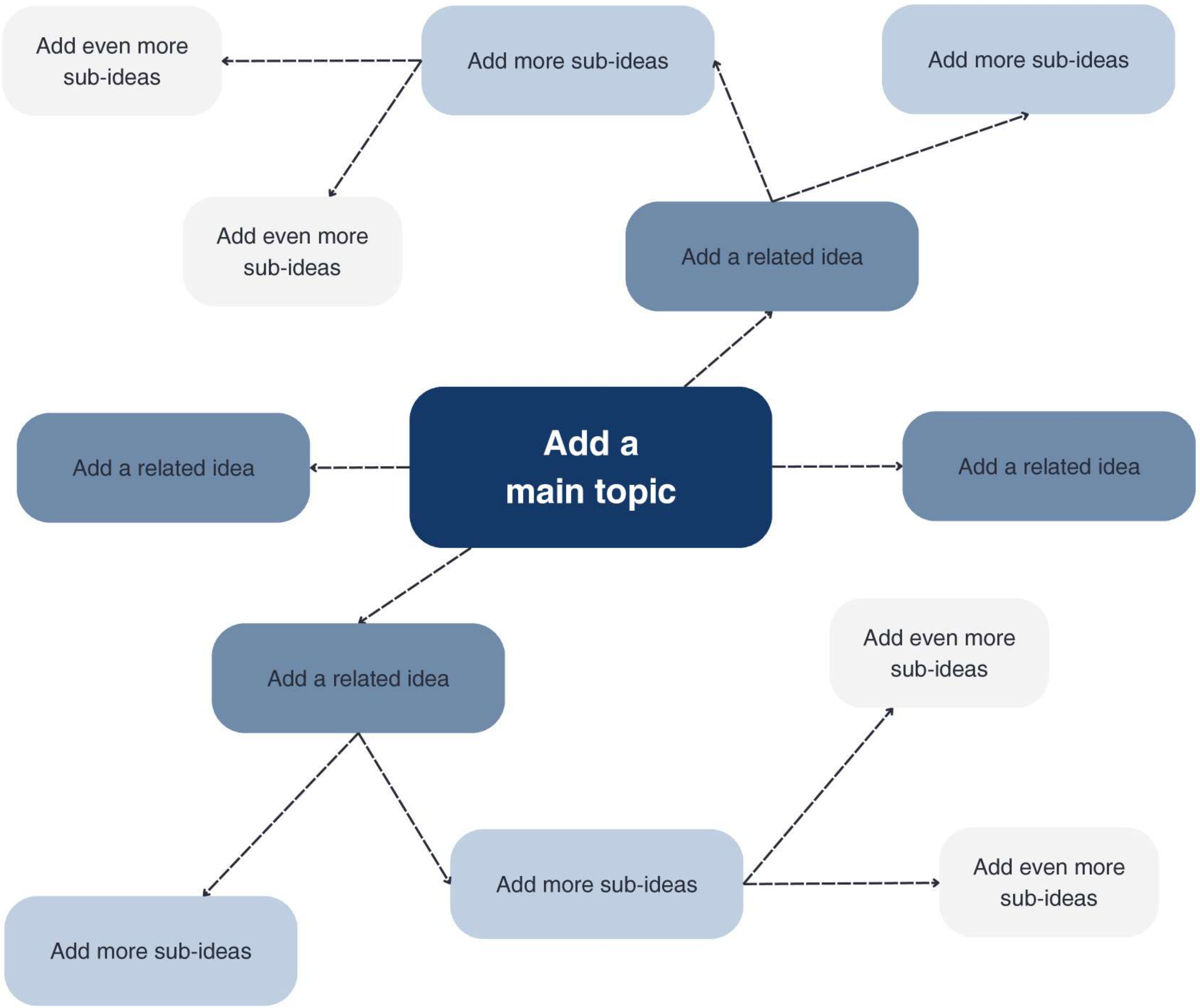

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