Reinforcement Learning for Solving the 8-Puzzle

Objective

The objective of this homework assignment is to implement a reinforcement learning algorithm to solve the 8-puzzle game using one of the following methods: **Markov Decision Processes (MDP)**, **Monte Carlo methods**, or **Dynamic Programming**.

Understanding the 8-Puzzle Game:
- Familiarize yourself with the rules and mechanics of the 8-puzzle game.
- Understand the concept of **state space**, **action space**, and the **goal state** in the context of the 8-puzzle.

Reinforcement Learning Algorithm:
- Choose one of the following methods: MDP, Monte Carlo methods, or Dynamic Programming.
- Implement the chosen method to learn the optimal policy for solving the 8-puzzle.
- Define the necessary components specific to the chosen method, such as value iteration for Dynamic Programming or state-value estimation for Monte Carlo methods.

Implementation:

Implement the environment for the 8-puzzle game.

This should include functions to:

- Initialize the puzzle with a random configuration.
- Provide the available actions from a given state.
- Perform an action and update the state accordingly.
- Check if the current state is the goal state.
- Calculate the reward for each action.

Training:
- Train your chosen reinforcement learning agent on a set of randomly generated initial states of the 8-puzzle.

- Define the training parameters such as learning rate, discount factor, exploration rate (if applicable), and the number of episodes or iterations.

Evaluation:

- Evaluate the performance of your reinforcement learning agent by testing it on a separate set of initial states.
- Measure the average number of steps taken to reach the goal state.
- Compare the performance of your agent with different sets of parameters.

Analysis and Discussion:

- Analyze the results obtained from the evaluation.
- Discuss the effectiveness and efficiency of the chosen method in solving the 8-puzzle problem.
- Identify any limitations or challenges faced during the implementation and suggest possible improvements.