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Github: https://github.com/calvinKLyeung/Calvin_3202_Taxi

Project overview

This project aims to implement the Q-Learning Algorithm and the Deep Q Learning Network (DQN) and compare the learning process and prediction result in the same environment. The implementation and the comparison is done with the Taxi game version 3 under the Toy Text environment provided by the OpenAI Gymnasium library. The Q-learning agent and the DQN agent are built using mainly NumPy and PyTorch libraries.

Approach

Environment

Description In the Taxi game environment, the Taxi agent is randomly spawned into a 5x5 grid world with 4 pick-up/drop-off locations on the Map in Red, Green, Yellow, and Blue colour respectively.
The goal of the game is to let the Taxi agent

1. navigate to the passenger's location
2. pick up the passenger
3. head to the passenger's desired destination (1 of the 4 locations)
4. drop off the passenger at that destination

End of Episode The Taxi game is terminated once the Taxi agent drops off the passenger.
An episode is truncated if the Taxi agent fails to terminate after 200 steps by default.

Game Id
"Taxi-v3"

Action Space
The Taxi agent has totally 6 actions to choose from the range of {0, 1, 2, 3, 4, 5}.
From 0 to 3, each of the number indicates the direction of action.
From 4 to 5, each of the number represents picking up or dropping off the passenger.

- 0 = Head South (Down)
- 1 = Head North (Up)
- 2 = Head East (Right)
- 3 = Head West (Left)

- 4 = Picking up the passenger
- 5 = Dropping off the passenger

Observation Space
In the 5x5 grid world, there are 25 valid position for the Taxi agent to be in.
The passenger can be in 5 unique locations {Red, Greed, Yellow, Blue, Taxi}.
And there are 4 destinations to drop off the passenger {Red, Greed, Yellow, Blue}.
In total, the Taxi game has $(5 \times 5) \times 5 \times 4 = 500$ discrete number of states with 6 possible actions.

Rewards
Incorrect attempts to pick up or drop off the passenger at the wrong location is punished with negative reward of -10.
Each step also comes with -1 negative reward as living penalty.
Successfully dropping off the passenger at the correct destination is encouraged with positive reward of $+20$.

Choice of model(s)

Q-learning Algorithm

Q-learning in reinforcement learning is essentially a lookup table algorithm. The Q-learning algorithm uses function approximator from a single experience to estimate the state-action and updates the result Q values in a lookup Q value table as reference for the agent to navigate. With the help of the epsilon greedy policy to switch between exploration and exploitation, Q-learning learns the optimal Q-values for every Q state and eventually converge to the optimal policy by taking suboptimal and random actions iteratively.

Deep-Q learning Network
The Deep-Q Network (DQN) is a reinforcement learning algorithm that combines the Q-learning Algorithm and multilayer networks (or neural networks). In essence, the DQN is the same idea as Q-learning in general but replaces the function approximator in the Q-learning with a deep neural network. The DQN takes the representation of the states in something like a one-hot encoded vector to approximate the Q value for output actions along with the weights and bias in the neural network. DQN learns from experience which consists of a state, an action, a reward, and the next state. To prevent learning from sequential experience which usually correlate with each other and lead to overfitting, DQN randomizes the training data before sending to the neural network. DQN does so by utilizing a Replay Memory buffer where a batch of random sample experience is passed on to the multilayer neural network for training only if the batch of experience is filled.

Methods and Purpose of Testing and Experiments

The project focuses on comparing the Q-learning and DQN algorithms in 4 major aspects:

- compare the average reward improvement during the training phase with controlled parameters
- compare prediction performance with controlled parameters
- compare the average reward improvement the training phase with fine-tuned parameters
- compare the prediction performance with fine-tuned parameters

Note:
Controlled parameters refer to using the same controlled value for parameters in common, like learning rate alpha, and discount rate gamma.
Fine-tuned parameters refer to manually fine-tuned and optimized parameters to maximize the reward prediction of the models.
Taxi agent is encouraged with higher reward if the shortest path and correct actions are being taken due to the living penalty, illegal action punishment, and correct action rewards.

Challenges and Trouble Shooting

Difficulty in setting up Stable Baselines for Taxi environment
Initially, the original plan of this project was to do a implementation and comparison between Q-learning, Deep-Q Network (DQN), Advantage Actor Critic (A2C), and Proximal Policy Optimization (PPO). However, after a long struggle, I was not able set the DQN, A2C, PRO models up to perform any decent prediction in the Taxi environment. The training phase of the models often ends abruptly after only a few episodes and the result prediction keeps telling the Taxi agent to run into a wall. I suspect the complex multilayer networks models do not really fit well for the Discrete and relatively small action and observation space of the Taxi problem and, hence, perform significantly worse than the Q-learning algorithm. Therefore, the project is eventually shifted its focus to the implementation and comparison between Q-learning and DQN using the NumPy and PyTorch libraries.

Designing and Implementing Q Learning Agent
Unlike the previous reinforcement learning homework where the series of Agents are already welled designed and implemented for students to only fill in the blanks of the Q-learning algorithm, this project needs to recreate a Q-learning agent in a completely new and different environment. Initially, I tried to mimic the Pacman agent design but soon realized that a lot of the component are just not necessary or do not fit for Taxi game environment, like the `getQvalue()`, `getPolicy()`, `getAction()` functions. The Taxi environment already has built-in solutions, like `env.step(action)`. Therefore, the project leans the essence of the Pacman agent design, that is, the object-oriented class hierarchy where there is first the Agent class, then the ValueEstimationAgent class, the ReinforcementLearningAgent class,

the QLearningAgent class, and finally the DQNAgent class. Based on this Object-Oriented design and the guidance of the huggingface deep reinforcement learning hands-on tutorial, this project adds its own constructors, fields, methods for the agent classes, including fields to instantiate and store the Taxi game environment and to represent Q value table space in NumPy array form for better performance.

Designing and Implementing DQN Agent

The DQN Agent design is heavily influenced by the PyTorch Reinforcement Learning (DQN) Tutorial. This is partly because I only have limited knowledge and understanding on how the neural networks works exactly and partly because I have no previous experience in building a neural network in PyTorch from scratch. After some struggling, I realized that the training and optimization functions from the PyTorch tutorial DQN cannot really run on the Taxi environment due to difference in PyTorch version and the Observation space. Unlike the ready-to-use DQN model from Stable Baselines which can be easily adjusted by fiddling the function parameters, the PyTorch DQN design requires manually delve into the nitty-gritty of the model which, unfortunately, is something I am not confident enough to get into at the moment. Eventually, I discovered another DQN tutorial that runs on a Discrete action and observation space of the Frozen Lake, a game environment similar yet different from the Taxi game. Following the tutorial video on YouTube Deep Q-Learning/Deep Q-Network (DQN) Explained | Python PyTorch Deep Reinforcement Learning and the demo code on GitHub, I gradually walk through and modify the DQN PyTorch model to fit for the requirement of the Taxi environment. Though, it was a massive challenge to figure out which part of the code is corresponding to which part of the DQN algorithm, like how to store the Replay Memory, when to batch the experience, how to train on the batch data in the 3 layers neural network, and when to use the optimizer properly.

Result: show the result and interpretation of your experiment. Any iterative improvements summary.

The following is the code implemented for Q-learning agent, DQN agent, and the performance comparison.

In [17]:
```
!pip install -U pip
!pip install -U torch
!pip install -U torchvision
!pip install gymnasium
!pip install matplotlib
!pip install imageio
```

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Requirement already satisfied: pillow>=8.3.2 in /opt/anaconda3/lib/python
3.12/site-packages (from imageio) (10.3.0)
```

In [1]:
```python
import gymnasium as gym
import ale_py
# if using gymnasium
import shimmy

# print(gym.envs.registry.keys())
gym.envs.registration.registry.keys()
```

Out[1]:
```
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2', 'Blackjack-v1', 'FrozenLake-v1', 'FrozenLake8x8-v1', 'CliffWalking-v
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am-v5', 'ALE/Superman-v5', 'ALE/Superman-ram-v5', 'ALE/Surround-v5', 'AL
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LE/Zaxxon-ram-v5', 'GymV26Environment-v0', 'GymV21Environment-v0'])

In [2]:
```python
import gymnasium as gym
# import math
import random
import matplotlib
import matplotlib.pyplot as plt
# from collections import namedtuple, deque
# from itertools import count
import numpy as np

import torch
import torch.nn as nn
import torch.optim as optim
import torch.nn.functional as F

# For visualization
import os
import imageio
from PIL import Image, ImageDraw, ImageFont
import matplotlib.pyplot as plt
%matplotlib inline
from IPython import display
```

```python
# from IPython.display import Image

import plotly.graph_objects as go
from plotly.subplots import make_subplots

from collections import deque

import json

# env = gym.make("CartPole-v1")
# env = gym.make("Taxi-v3")#, render_mode="rgb_array")
# env = gym.make("ALE/DonkeyKong-v5")

# set up matplotlib
is_ipython = 'inline' in matplotlib.get_backend()
if is_ipython:
    from IPython import display

plt.ion()

# if GPU exist, use GPU
device = torch.device(
    "cuda" if torch.cuda.is_available() else
    "mps" if torch.backends.mps.is_available() else
    "cpu"
)
```

In [3]:
```python
gym.__version__
```

Out[3]: `'1.0.0a2'`

Making Agent

In [6]:
```python
class Agent:
    def __init__(self, game_id, render_mode):
        self.game_id = game_id # game id
        self.render_mode = render_mode
        self.env = gym.make(game_id, render_mode=render_mode)
        # self.state = self.env.reset()
        # self.rewards = []
        # self.steps = []
        # self.poilcy = []

    def select_action(self, state, action):
        return action

    # ========== Display on screen ==========
    # Reference: https://stackoverflow.com/questions/40195740/how-to-run-
    def display_state_on_screen(self, episode, step, info=""):
        plt.figure(3)
        plt.clf()
        plt.imshow(self.env.render())
        plt.title("%s | Episode: %d | Step: %d %s" % (self.env.spec.id, e
        plt.axis('off')
```

```
        display.clear_output(wait=True)
        display.display(plt.gcf())
    # ========== Display on screen ==========

    # ========== to gif ==========
    # Reference: https://github.com/yuchen071/DQN-for-LunarLander-v2/blob
    def add_text_on_img(self, img, score, episode, step):
        img = Image.fromarray(img)
        draw = ImageDraw.Draw(img)
        draw.text((20, 20), f"Score={score: .2f}, Episode={episode}, Step

        return np.array(img)

    def save_frames_as_gif(self, frames, filename, path="gifs/"):
        if not os.path.exists(path):
            os.makedirs(path)

        print("Saving gif...", end="")
        imageio.mimsave(path + filename + ".gif", frames, fps=60)

        print("Done!")
    # ========== to gif ==========
```

In [7]:
```
class ValueEstimationAgent(Agent):
    def __init__(self, game_id, render_mode, gamma):
        Agent.__init__(self, game_id, render_mode)
        self.gamma = gamma  # discount rate


    def select_action(self, state, action):
        return action
```

In [8]:
```
class ReinforcementLearningAgent(ValueEstimationAgent):
    def __init__(self, game_id, render_mode, gamma, alpha):
        ValueEstimationAgent.__init__(self, game_id, render_mode, gamma)
        self.alpha = alpha   # alpha learning rate

    def select_action(self, state, action):
            return action
```

Making Q Learning Agent

In [10]:
```
# Reference: https://huggingface.co/learn/deep-rl-course/unit2/hands-on

class QLearningAgent(ReinforcementLearningAgent):
    def __init__(self, game_id, render_mode, gamma, alpha, epsilon, epsil
        ReinforcementLearningAgent.__init__(self, game_id, render_mode, g
        #self.game_id
        #self.render_mode
        #self.env=env
        #self.alpha=alpha
```

```python
        #self.gamma=gamma

        self.epsilon = epsilon                      # epsilon greedy policy
        self.epsilon_start = epsilon_start          # starting epsilon, usually
        self.epsilon_end = epsilon_end              # ending epsilon, usually 0
        self.epsilon_decay = epsilon_decay          # fixed epsilon decay value
        self.max_steps = max_steps                  # set max steps for each ep
        # replace max_episode_steps of the env with the given max_steps
        self.env._max_episode_steps = self.max_steps  # TAXI default max

        # store the numer of states and actions of the env for easier acc
        self.num_states = self.env.observation_space.n
        self.num_actions = self.env.action_space.n

        # Q value table in numpy array of array form initialize to 0
        self.Q_space = np.zeros((self.num_states, self.num_actions))  # s

        self.result_model_name = result_model_name


    def select_action(self, state, action):
        return action

    def epsilon_greedy_policy(self, state):# Q_space, state):
        # if random number between [0 : 1) > epsilon --> exploitation
        if(random.random() > self.epsilon):
            # read argument action with max q value among the 6 actions o
            action = np.argmax(self.Q_space[state][:])
        # else --> exploration
        else:
            action = self.env.action_space.sample()  # pick random action

        return action

    def train(self, episodes):# , decay_rate):

        # rewards from each episode !
        rewards_per_episode = np.zeros(episodes)

        # record epsilon for display
        epsilon_history = []


        for episode in range(episodes):
            # Reset the environment
            observation = self.env.reset()
            state = observation[0]   # state is the 1st elem in the self.

            # acc total reward per episode
            total_reward = 0



            for step in range(self.max_steps):

                action = self.epsilon_greedy_policy(state)
```

```python
            # Epsilon decay as we need fewer exploration as time pass
            # Exponential Decay of epsilon
            # refernce: https://medium.com/@CalebMBowyer/strategies-f
            decay_factor = (self.epsilon_end/self.epsilon_start)**(1/
            # update self.epsilon
            self.epsilon = self.epsilon * decay_factor




            # append updated epsilon to the record
            epsilon_history.append(self.epsilon)

            # https://colab.research.google.com/github/erodola/ML-s2-
            # decay_rate = 0.0005 # 1000
            # self.epsilon = self.epsilon_end + (self.epsilon_start -


            # Take the action (a) and observe the outcome state(s') a
            # new_state, reward, done, info = env.step(action)
            # observation, reward, terminated, truncated, info


            new_state, reward, terminated, truncated, info = self.env

            # acc reward to toal_reward to keep track of the total_re
            total_reward += reward

            # Update Q(s,a):= Q(s,a) + lr_alpha [R(s,a) + gamma * max
            # print(state)
            # print(action)
            #Q_space[state][action] = Q_space[state][action] + learni
                                    #np.max(Q_space[new_state]) -

            sample = reward + self.gamma * np.max(self.Q_space[new_st
            self.Q_space[state][action] = (1 - self.alpha) * self.Q_s

            # if the number of steps elapsed >= max episode steps (20
            # If terminated --> finish current episode
            if terminated == True or truncated == True:
                break

            # update to state to new_state
            state = new_state


        # store the total reward of each episode for record
        rewards_per_episode[episode] = total_reward

        # print the progress
        i = episode
        if (i + 1) % 100 == 0:
            print(f"Episode {i+1}/{episodes}, Avg Reward: {np.mean(re


    self.env.close()
```

```python
        # Create new graph
        plt.figure(1)

        # Plot average rewards (Y-axis) vs episodes (X-axis)
        sum_rewards = np.zeros(episodes)
        for x in range(episodes):
            sum_rewards[x] = np.sum(rewards_per_episode[max(0, x-100):(x+
        plt.subplot(121) # plot on a 1 row x 2 col grid, at cell 1
        plt.plot(sum_rewards)

        # Plot epsilon decay (Y-axis) vs episodes (X-axis)
        plt.subplot(122) # plot on a 1 row x 2 col grid, at cell 2
        plt.plot(epsilon_history)

        # Save plots
        plt.savefig(self.result_model_name + '.png')

        return rewards_per_episode


    def test(self, test_episodes=10, display=False):

        episode_reward_lst = []

        frames = []


        for episode in range(test_episodes): # total_test_episodes == 10
            observation = self.env.reset()
            state = observation[0]

            total_reward = 0
            print("================================================
            print("EPISODE ", episode)


            # added
            steps_count = 0
            for step in range(self.max_steps):

                # Take the action (index) that have the maximum expected
                action = np.argmax(self.Q_space[state][:])

                # apply selected action
                new_state, reward, terminated, truncated, info = self.env

                # add up reward for later calculation
                total_reward += reward
                # increment step for displaying state on screen
                steps_count += 1

                if (display == True):
                    # Display on Screen
                    self.display_state_on_screen(episode, steps_count)  #
```

```python
            if terminated == True or truncated == True :
                episode_reward_lst.append(total_reward)
                print ("Score of total rewards:", total_reward)
                break
            state = new_state  # Update state to new_state

    self.env.close()
    # print("Total Steps taken:", steps_count)
    print ("Average score over time: " +  str(sum(episode_reward_lst)
    return episode_reward_lst



# turn test scenario to gif
def test_to_gif(self, filename="q_learning_result", episodes=5):


    frames = []
    for episode in range(episodes):
        observation = self.env.reset()
        state = observation[0]

        score = 0
        for step in range(self.max_steps):
            # store rgb ender to frame
            frame = self.env.render()
            # store the rendered frame to list
            frames.append(self.add_text_on_img(frame, score, episode,

            # selected from the Q value table
            action = np.argmax(self.Q_space[state][:])


            # print current episode, action, state
            print(f"episodes: {episode}, acton: {action}, state: {sta


            # apply selected action
            state, reward, terminated, truncated, info = self.env.ste

            score += reward

            if terminated == True or truncated == True:
                break
    self.env.close()
    # turn frames into gif
    self.save_frames_as_gif(frames, filename=filename)
```

Deep Q Learning (DQN) agent

```
In [18]:   # Defining models
           # Reference:
           # https://pytorch.org/tutorials/intermediate/reinforcement_q_learning.htm
           # https://colab.research.google.com/github/pytorch/tutorials/blob/gh-page
           # https://www.youtube.com/watch?si=fXl8PEnb0TrV9Vwt&v=EUrWGTCGzlA&feature

           # DQN model
           class DQN(nn.Module):
               # 3 layers multi layers learning network
               def __init__(self, in_states, h1_nodes, out_actions):
                   super().__init__()
                   self.fc1 = nn.Linear(in_states, h1_nodes)      # Input layer = 500
                   self.fc2 = nn.Linear(h1_nodes, h1_nodes)       # hidden layer
                   self.out = nn.Linear(h1_nodes, out_actions)    # output layer = 6

               def forward(self, x):
                   # Rectified Linear Unit (ReLU)
                   x = F.relu(self.fc1(x))      # run Input layer
                   x = F.relu(self.fc2(x))      # run hidden layer
                   x = self.out(x)              # run output layer
                   return x

           # Define memory for Experience Replay
           class ReplayMemory():
               def __init__(self, maxlen):
                   self.memory = deque([], maxlen=maxlen)

               def append(self, transition):
                   self.memory.append(transition)

               def sample(self, sample_size):
                   return random.sample(self.memory, sample_size)

               def __len__(self):
                   return len(self.memory)


In [20]:   class DQNAgent(QLearningAgent):
               def __init__(self, game_id, render_mode, gamma, alpha, epsilon, epsil
                   QLearningAgent.__init__(self, game_id, render_mode, gamma, alpha,

                   #self.game_id
                   #self.render_mode
                   #self.env=env
                   #self.alpha=alpha
                   #self.gamma=gamma

                   #self.epsilon = epsilon                      # epsilon greedy policy
                   #self.epsilon_start = epsilon_start    # starting epsilon, usuall
                   #self.epsilon_end = epsilon_end         # ending epsilon, usually
                   #self.epsilon_decay = epsilon_decay    # fixed epsilon decay valu
                   #self.max_steps = max_steps              # set max steps for each e
                   ## replace max_episode_steps of the env with the given max_steps
                   #self.env._max_episode_steps = self.max_steps  # TAXI default max

                   ## store the numer of states and actions of the env for easier ac
```

```python
        #self.num_states = self.env.observation_space.n
        #self.num_actions = self.env.action_space.n

        ## Q value table in numpy array of array form initialize to 0
        #self.Q_space = np.zeros((self.num_states, self.num_actions))  #

        #self.result_model_name = result_model_name

    # ---------------------- Special Parameters for DQN only -----------
    network_sync_rate_tau = 10   # after 10 steps, sync policy network an
    replay_memory_size = 10000
    mini_batch_size = 64

    loss_fn = nn.MSELoss()   # Mean Squared Error Loss function
    optimizer = None          # initialize later on

    ACTIONS = ['S', 'N', 'E', 'W', 'P', 'D']  # South, North, East, West,
    # ---------------------- Special Parameters for DQN only -----------

    def train(self, episodes):

        # epsilon = 1

        # self.env = gym.make(self.game_id, render_mode=self.render_mode
        # num_states = self.env.observation_space.n
        # num_actions = self.env.action_space.n

        # Epsilon
        # epsilon_start = 1
        # epsilon_end = 0.001

        # set up ReplayMemory obj to store the experience
        memory = ReplayMemory(self.replay_memory_size)

        # need 2 neural networks
        # 1) policy network for training
        # 2) target network makes use of the deep q learning equation
        policy_dqn = DQN(in_states=self.num_states, h1_nodes=128, out_act
        target_dqn = DQN(in_states=self.num_states, h1_nodes=128, out_act


        # copy policy network to target network
        target_dqn.load_state_dict(policy_dqn.state_dict())

        # neural network initially comes with a random set of weights and
        print('Policy (policy network model before training with randomly
        self.print_dqn(policy_dqn)

        # initialize and store Adam optimizer
        self.optimizer = torch.optim.Adam(policy_dqn.parameters(), lr=sel

        # rewards from each episode !
        rewards_per_episode = np.zeros(episodes)

        # record epsilon for display
        epsilon_history = []
```

```python
        # track how many steps has been taken, sync policy network and ta
        step_count = 0

        for episode in range(episodes):
            state, _ = self.env.reset()
            total_reward = 0
            terminated = False    # True when the taxi drops off the pass
            truncated = False     # True when the length of steps in a si

            while not terminated and not truncated:


                # =============== Epsilon Greedy Algorithm Section ======
                if random.random() < self.epsilon:
                    # Random action
                    action = self.env.action_space.sample()
                else:
                    # torch.no_grad() tells pytorch not to calculate new
                    with torch.no_grad():
                        # Use policy network to calculate a set of q valu
                        # self.state_to_dqn_input() encodes state to one-
                        action = policy_dqn(self.state_to_dqn_input(state
                # =============== Epsilon Greedy Algorithm Section ======

                # run the action in the env
                new_state, reward, terminated, truncated, _ = self.env.st

                # Memoize the experience, append to the ReplayMemory
                memory.append((state, action, new_state, reward, terminat

                # update state to the new state
                state = new_state

                # increment
                total_reward += reward
                step_count += 1

            # store the total reward of each episode for record
            rewards_per_episode[episode] = total_reward


            # Check if enough experience has been collected for a batch
            if len(memory) > self.mini_batch_size:
                mini_batch = memory.sample(self.mini_batch_size)


                # optimize
                self.optimize(mini_batch, policy_dqn, target_dqn)


                # Exponential epsilon decay factor !!!!
                decay_factor = (self.epsilon_end/self.epsilon_start)**(1/
                self.epsilon = self.epsilon * decay_factor

                # https://colab.research.google.com/github/erodola/ML-s2-
                # decay_rate = 0.0005 # 1000
```

```python
            # episode = i  # rename i to episode for the calculation
            # print(self.epsilon, episode)
            # self.epsilon = self.epsilon_end + (self.epsilon_start -

            # record the epsilon value for later
            epsilon_history.append(self.epsilon)

            # if overstep, load instead of train
            if step_count > self.network_sync_rate_tau:
                target_dqn.load_state_dict(policy_dqn.state_dict())
                step_count = 0


        # print the progress
        if (episode + 1) % 100 == 0:
            print(f"Episode {episode+1}/{episodes}, Avg Reward: {np.m

    self.env.close()

    torch.save(policy_dqn.state_dict(), self.result_model_name + ".pt


    print("!!!!!!!!!!!!!!!!!Trained and Stored the model successfully!



    # Display the training progress into png

    # Create new graph
    plt.figure(1)

    # Plot average rewards (Y-axis) vs episodes (X-axis)
    sum_rewards = np.zeros(episodes)
    for x in range(episodes):
        sum_rewards[x] = np.sum(rewards_per_episode[max(0, x-100):(x+
    plt.subplot(121) # plot on a 1 row x 2 col grid, at cell 1
    plt.plot(sum_rewards)

    # Plot epsilon decay (Y-axis) vs episodes (X-axis)
    plt.subplot(122) # plot on a 1 row x 2 col grid, at cell 2
    plt.plot(epsilon_history)

    # Save plots
    plt.savefig(self.result_model_name + '.png') # 'taxi_dql.png')

    return rewards_per_episode

def optimize(self, mini_batch, policy_dqn, target_dqn):# , num_states
    current_q_list = []
    target_q_list = []

    for state, action, new_state, reward, terminated in mini_batch:
        if terminated:
            target = torch.FloatTensor([reward])
        else:
            with torch.no_grad():
```

```python
                target = torch.FloatTensor(
                    reward + self.gamma * target_dqn(self.state_to_dq
                )
            # Q value update
            current_q = policy_dqn(self.state_to_dqn_input(state))
            target_q = current_q.clone().detach()
            target_q[action] = target

            current_q_list.append(current_q)
            target_q_list.append(target_q)

        loss = self.loss_fn(torch.stack(current_q_list), torch.stack(targ

        self.optimizer.zero_grad()
        loss.backward()
        self.optimizer.step()

    # turn state into one-hot encoding tensor vector
    def state_to_dqn_input(self, state: int)-> torch.Tensor: # , num_stat
        input_tensor = torch.zeros(self.num_states)
        input_tensor[state] = 1
        return input_tensor


    def test(self, test_episodes=10, display=False):
        # self.env = gym.make('Taxi-v3', render_mode=self.render_mode) #
        # num_states = self.env.observation_space.n
        # num_actions = self.env.action_space.n

        policy_dqn = DQN(in_states=self.num_states, h1_nodes=128, out_act
        policy_dqn.load_state_dict(torch.load(self.result_model_name + ".
        policy_dqn.eval()

        print('Policy (trained policy network model from the .pt file):')
        self.print_dqn(policy_dqn)

        episode_reward_lst = list()


        for episode in range(test_episodes):
            state, _ = self.env.reset()
            total_reward = 0
            terminated = False
            truncated = False


            # steps_count for dispaly
            steps_count = 0

            # while not terminated and not truncated:
            for step in range(self.max_steps):

                with torch.no_grad():
                    action = policy_dqn(self.state_to_dqn_input(state)).a

                state, reward, terminated, truncated, _ = self.env.step(a
                total_reward += reward
```

```python
                steps_count += 1


                # only display the Game if being asked to do so
                if (display == True):
                    self.display_state_on_screen(episode, steps_count)


                if (terminated == True or truncated == True):
                    episode_reward_lst.append(total_reward)
                    print(f"Episode {episode+1}: Total Reward = {total_re
                    break

            # print(f"Episode {episode+1}: Total Reward = {total_reward}"
            # episode_reward_lst.append(total_reward)

        self.env.close()
        print(f"Average Reward across all Episodes: = {sum(episode_reward

        return episode_reward_lst

    # print the initial states and values before the training
    def print_dqn(self, dqn): # , num_states):
        for s in range(self.num_states):
            q_values = dqn(self.state_to_dqn_input(s)).tolist()
            q_values_str = ' '.join([f"{q:+.2f}" for q in q_values])
            best_action = self.ACTIONS[dqn(self.state_to_dqn_input(s)).ar
            print(f'State {s:03}, Action {best_action}, Q-values: [{q_val

    def test_to_gif(self, filename="dqn_learning_result", episodes=3):
        # capture each frame
        frames = []

        # make DQN for loading policy network
        policy_dqn = DQN(in_states=self.num_states, h1_nodes=128, out_act
        # load and eval the trained policy network
        policy_dqn.load_state_dict(torch.load(self.result_model_name + ".
        policy_dqn.eval()

        print('Policy (trained):')
        self.print_dqn(policy_dqn)

        episode_reward_lst = list()


        for episode in range(episodes):
            # reset env for each episodes == episode
            observation = self.env.reset()
            state = observation[0]


            total_reward = 0
            steps_count = 0
```

```python
            # for display on the image
            score = 0
            for step in range(self.max_steps):
                frame = self.env.render()
                frames.append(self.add_text_on_img(frame, score, episode,

                # tell torch to not train but to predict
                with torch.no_grad():
                    # read max action from the trained policy network
                    action = policy_dqn(self.state_to_dqn_input(state)).a

                print(f"episodes: {episode}, acton: {action}, state: {sta

                state, reward, terminated, truncated, _ = self.env.step(a

                score += reward
                total_reward += reward
                steps_count += 1

                if terminated == True or truncated == True:

                    episode_reward_lst.append(total_reward)
                    print(f"Episode {episode+1}: Total Reward = {total_re
                    break
            self.env.close()
            self.save_frames_as_gif(frames, filename=filename)
            print(f"Average Reward across all Episodes: = {sum(episode_reward
```

Testing and Comparison

Controlled Parameter Training

Q Learning Agent with Controlled Parameters

```python
In [46]: my_q_agent_controlled = QLearningAgent(game_id="Taxi-v3", render_mode="rg
                                    gamma=0.95, alpha=0.5, epsilon=1.0
                                    epsilon_decay=1000, epsilon_end=0.
                                    result_model_name="taxi_q_controll
```

```python
In [48]: %%time
         my_q_agent_controlled_training_rewards = my_q_agent_controlled.train(1000
```

```
Episode 100/100000, Avg Reward: -475.26, Epsilon: 0.31
Episode 200/100000, Avg Reward: -126.28, Epsilon: 0.17
Episode 300/100000, Avg Reward: -28.88, Epsilon: 0.13
Episode 400/100000, Avg Reward: -5.45, Epsilon: 0.12
Episode 500/100000, Avg Reward: -1.74, Epsilon: 0.10
Episode 600/100000, Avg Reward: 1.49, Epsilon: 0.09
Episode 700/100000, Avg Reward: 1.59, Epsilon: 0.08
Episode 800/100000, Avg Reward: 3.10, Epsilon: 0.08
Episode 900/100000, Avg Reward: 4.22, Epsilon: 0.07
Episode 1000/100000, Avg Reward: 3.95, Epsilon: 0.06
```

```
Episode 1100/100000, Avg Reward: 4.98, Epsilon: 0.06
Episode 1200/100000, Avg Reward: 5.65, Epsilon: 0.05
Episode 1300/100000, Avg Reward: 5.35, Epsilon: 0.05
Episode 1400/100000, Avg Reward: 6.35, Epsilon: 0.04
Episode 1500/100000, Avg Reward: 5.55, Epsilon: 0.04
Episode 1600/100000, Avg Reward: 5.37, Epsilon: 0.03
Episode 1700/100000, Avg Reward: 5.77, Epsilon: 0.03
Episode 1800/100000, Avg Reward: 6.47, Epsilon: 0.03
Episode 1900/100000, Avg Reward: 6.47, Epsilon: 0.03
Episode 2000/100000, Avg Reward: 6.79, Epsilon: 0.02
Episode 2100/100000, Avg Reward: 7.15, Epsilon: 0.02
Episode 2200/100000, Avg Reward: 7.04, Epsilon: 0.02
Episode 2300/100000, Avg Reward: 7.38, Epsilon: 0.02
Episode 2400/100000, Avg Reward: 7.25, Epsilon: 0.02
Episode 2500/100000, Avg Reward: 7.31, Epsilon: 0.02
Episode 2600/100000, Avg Reward: 7.32, Epsilon: 0.01
Episode 2700/100000, Avg Reward: 8.03, Epsilon: 0.01
Episode 2800/100000, Avg Reward: 6.94, Epsilon: 0.01
Episode 2900/100000, Avg Reward: 7.32, Epsilon: 0.01
Episode 3000/100000, Avg Reward: 7.48, Epsilon: 0.01
Episode 3100/100000, Avg Reward: 7.31, Epsilon: 0.01
Episode 3200/100000, Avg Reward: 7.95, Epsilon: 0.01
Episode 3300/100000, Avg Reward: 6.92, Epsilon: 0.01
Episode 3400/100000, Avg Reward: 7.73, Epsilon: 0.01
Episode 3500/100000, Avg Reward: 8.07, Epsilon: 0.01
Episode 3600/100000, Avg Reward: 8.13, Epsilon: 0.01
Episode 3700/100000, Avg Reward: 7.89, Epsilon: 0.01
Episode 3800/100000, Avg Reward: 7.24, Epsilon: 0.00
Episode 3900/100000, Avg Reward: 7.54, Epsilon: 0.00
Episode 4000/100000, Avg Reward: 8.30, Epsilon: 0.00
Episode 4100/100000, Avg Reward: 7.29, Epsilon: 0.00
Episode 4200/100000, Avg Reward: 7.94, Epsilon: 0.00
Episode 4300/100000, Avg Reward: 7.97, Epsilon: 0.00
Episode 4400/100000, Avg Reward: 7.58, Epsilon: 0.00
Episode 4500/100000, Avg Reward: 8.22, Epsilon: 0.00
Episode 4600/100000, Avg Reward: 7.40, Epsilon: 0.00
Episode 4700/100000, Avg Reward: 7.83, Epsilon: 0.00
Episode 4800/100000, Avg Reward: 7.70, Epsilon: 0.00
Episode 4900/100000, Avg Reward: 7.99, Epsilon: 0.00
Episode 5000/100000, Avg Reward: 8.16, Epsilon: 0.00
Episode 5100/100000, Avg Reward: 7.66, Epsilon: 0.00
Episode 5200/100000, Avg Reward: 7.92, Epsilon: 0.00
Episode 5300/100000, Avg Reward: 7.94, Epsilon: 0.00
Episode 5400/100000, Avg Reward: 7.86, Epsilon: 0.00
Episode 5500/100000, Avg Reward: 7.57, Epsilon: 0.00
Episode 5600/100000, Avg Reward: 7.57, Epsilon: 0.00
Episode 5700/100000, Avg Reward: 8.26, Epsilon: 0.00
Episode 5800/100000, Avg Reward: 7.89, Epsilon: 0.00
Episode 5900/100000, Avg Reward: 7.77, Epsilon: 0.00
Episode 6000/100000, Avg Reward: 8.24, Epsilon: 0.00
Episode 6100/100000, Avg Reward: 7.68, Epsilon: 0.00
Episode 6200/100000, Avg Reward: 7.56, Epsilon: 0.00
Episode 6300/100000, Avg Reward: 7.94, Epsilon: 0.00
Episode 6400/100000, Avg Reward: 7.57, Epsilon: 0.00
Episode 6500/100000, Avg Reward: 7.45, Epsilon: 0.00
Episode 6600/100000, Avg Reward: 7.94, Epsilon: 0.00
Episode 6700/100000, Avg Reward: 8.11, Epsilon: 0.00
```

```
Episode 6800/100000, Avg Reward: 8.17, Epsilon: 0.00
Episode 6900/100000, Avg Reward: 8.25, Epsilon: 0.00
Episode 7000/100000, Avg Reward: 7.63, Epsilon: 0.00
Episode 7100/100000, Avg Reward: 7.62, Epsilon: 0.00
Episode 7200/100000, Avg Reward: 7.86, Epsilon: 0.00
Episode 7300/100000, Avg Reward: 8.12, Epsilon: 0.00
Episode 7400/100000, Avg Reward: 7.79, Epsilon: 0.00
Episode 7500/100000, Avg Reward: 8.08, Epsilon: 0.00
Episode 7600/100000, Avg Reward: 8.10, Epsilon: 0.00
Episode 7700/100000, Avg Reward: 7.73, Epsilon: 0.00
Episode 7800/100000, Avg Reward: 7.81, Epsilon: 0.00
Episode 7900/100000, Avg Reward: 7.76, Epsilon: 0.00
Episode 8000/100000, Avg Reward: 7.41, Epsilon: 0.00
Episode 8100/100000, Avg Reward: 8.32, Epsilon: 0.00
Episode 8200/100000, Avg Reward: 8.14, Epsilon: 0.00
Episode 8300/100000, Avg Reward: 8.14, Epsilon: 0.00
Episode 8400/100000, Avg Reward: 8.13, Epsilon: 0.00
Episode 8500/100000, Avg Reward: 8.46, Epsilon: 0.00
Episode 8600/100000, Avg Reward: 7.42, Epsilon: 0.00
Episode 8700/100000, Avg Reward: 7.70, Epsilon: 0.00
Episode 8800/100000, Avg Reward: 7.68, Epsilon: 0.00
Episode 8900/100000, Avg Reward: 7.75, Epsilon: 0.00
Episode 9000/100000, Avg Reward: 7.96, Epsilon: 0.00
Episode 9100/100000, Avg Reward: 8.09, Epsilon: 0.00
Episode 9200/100000, Avg Reward: 8.14, Epsilon: 0.00
Episode 9300/100000, Avg Reward: 8.20, Epsilon: 0.00
Episode 9400/100000, Avg Reward: 7.91, Epsilon: 0.00
Episode 9500/100000, Avg Reward: 7.77, Epsilon: 0.00
Episode 9600/100000, Avg Reward: 8.22, Epsilon: 0.00
Episode 9700/100000, Avg Reward: 8.04, Epsilon: 0.00
Episode 9800/100000, Avg Reward: 7.95, Epsilon: 0.00
Episode 9900/100000, Avg Reward: 8.02, Epsilon: 0.00
Episode 10000/100000, Avg Reward: 8.01, Epsilon: 0.00
Episode 10100/100000, Avg Reward: 7.77, Epsilon: 0.00
Episode 10200/100000, Avg Reward: 7.64, Epsilon: 0.00
Episode 10300/100000, Avg Reward: 7.80, Epsilon: 0.00
Episode 10400/100000, Avg Reward: 8.04, Epsilon: 0.00
Episode 10500/100000, Avg Reward: 8.21, Epsilon: 0.00
Episode 10600/100000, Avg Reward: 7.80, Epsilon: 0.00
Episode 10700/100000, Avg Reward: 8.03, Epsilon: 0.00
Episode 10800/100000, Avg Reward: 7.68, Epsilon: 0.00
Episode 10900/100000, Avg Reward: 7.55, Epsilon: 0.00
Episode 11000/100000, Avg Reward: 8.02, Epsilon: 0.00
Episode 11100/100000, Avg Reward: 7.65, Epsilon: 0.00
Episode 11200/100000, Avg Reward: 7.78, Epsilon: 0.00
Episode 11300/100000, Avg Reward: 7.56, Epsilon: 0.00
Episode 11400/100000, Avg Reward: 8.03, Epsilon: 0.00
Episode 11500/100000, Avg Reward: 7.47, Epsilon: 0.00
Episode 11600/100000, Avg Reward: 8.04, Epsilon: 0.00
Episode 11700/100000, Avg Reward: 7.63, Epsilon: 0.00
Episode 11800/100000, Avg Reward: 8.01, Epsilon: 0.00
Episode 11900/100000, Avg Reward: 7.95, Epsilon: 0.00
Episode 12000/100000, Avg Reward: 8.26, Epsilon: 0.00
Episode 12100/100000, Avg Reward: 8.16, Epsilon: 0.00
Episode 12200/100000, Avg Reward: 7.84, Epsilon: 0.00
Episode 12300/100000, Avg Reward: 7.79, Epsilon: 0.00
Episode 12400/100000, Avg Reward: 7.92, Epsilon: 0.00
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Episode 12500/100000, Avg Reward: 7.99, Epsilon: 0.00
Episode 12600/100000, Avg Reward: 7.57, Epsilon: 0.00
Episode 12700/100000, Avg Reward: 7.78, Epsilon: 0.00
Episode 12800/100000, Avg Reward: 7.80, Epsilon: 0.00
Episode 12900/100000, Avg Reward: 7.69, Epsilon: 0.00
Episode 13000/100000, Avg Reward: 8.25, Epsilon: 0.00
Episode 13100/100000, Avg Reward: 7.56, Epsilon: 0.00
Episode 13200/100000, Avg Reward: 7.79, Epsilon: 0.00
Episode 13300/100000, Avg Reward: 7.53, Epsilon: 0.00
Episode 13400/100000, Avg Reward: 7.81, Epsilon: 0.00
Episode 13500/100000, Avg Reward: 7.89, Epsilon: 0.00
Episode 13600/100000, Avg Reward: 7.75, Epsilon: 0.00
Episode 13700/100000, Avg Reward: 7.62, Epsilon: 0.00
Episode 13800/100000, Avg Reward: 8.27, Epsilon: 0.00
Episode 13900/100000, Avg Reward: 8.17, Epsilon: 0.00
Episode 14000/100000, Avg Reward: 7.54, Epsilon: 0.00
Episode 14100/100000, Avg Reward: 8.04, Epsilon: 0.00
Episode 14200/100000, Avg Reward: 8.21, Epsilon: 0.00
Episode 14300/100000, Avg Reward: 8.26, Epsilon: 0.00
Episode 14400/100000, Avg Reward: 7.88, Epsilon: 0.00
Episode 14500/100000, Avg Reward: 8.03, Epsilon: 0.00
Episode 14600/100000, Avg Reward: 8.21, Epsilon: 0.00
Episode 14700/100000, Avg Reward: 7.78, Epsilon: 0.00
Episode 14800/100000, Avg Reward: 7.69, Epsilon: 0.00
Episode 14900/100000, Avg Reward: 7.77, Epsilon: 0.00
Episode 15000/100000, Avg Reward: 7.41, Epsilon: 0.00
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Episode 15300/100000, Avg Reward: 7.86, Epsilon: 0.00
Episode 15400/100000, Avg Reward: 7.96, Epsilon: 0.00
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Episode 15700/100000, Avg Reward: 8.25, Epsilon: 0.00
Episode 15800/100000, Avg Reward: 7.60, Epsilon: 0.00
Episode 15900/100000, Avg Reward: 7.66, Epsilon: 0.00
Episode 16000/100000, Avg Reward: 7.93, Epsilon: 0.00
Episode 16100/100000, Avg Reward: 7.61, Epsilon: 0.00
Episode 16200/100000, Avg Reward: 7.87, Epsilon: 0.00
Episode 16300/100000, Avg Reward: 8.23, Epsilon: 0.00
Episode 16400/100000, Avg Reward: 8.26, Epsilon: 0.00
Episode 16500/100000, Avg Reward: 7.80, Epsilon: 0.00
Episode 16600/100000, Avg Reward: 8.22, Epsilon: 0.00
Episode 16700/100000, Avg Reward: 7.76, Epsilon: 0.00
Episode 16800/100000, Avg Reward: 7.90, Epsilon: 0.00
Episode 16900/100000, Avg Reward: 7.53, Epsilon: 0.00
Episode 17000/100000, Avg Reward: 7.96, Epsilon: 0.00
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Episode 17300/100000, Avg Reward: 8.27, Epsilon: 0.00
Episode 17400/100000, Avg Reward: 8.27, Epsilon: 0.00
Episode 17500/100000, Avg Reward: 8.07, Epsilon: 0.00
Episode 17600/100000, Avg Reward: 8.06, Epsilon: 0.00
Episode 17700/100000, Avg Reward: 7.96, Epsilon: 0.00
Episode 17800/100000, Avg Reward: 8.09, Epsilon: 0.00
Episode 17900/100000, Avg Reward: 8.19, Epsilon: 0.00
Episode 18000/100000, Avg Reward: 8.06, Epsilon: 0.00
Episode 18100/100000, Avg Reward: 7.79, Epsilon: 0.00
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Episode 18200/100000, Avg Reward: 8.05, Epsilon: 0.00
Episode 18300/100000, Avg Reward: 7.70, Epsilon: 0.00
Episode 18400/100000, Avg Reward: 8.07, Epsilon: 0.00
Episode 18500/100000, Avg Reward: 7.61, Epsilon: 0.00
Episode 18600/100000, Avg Reward: 7.62, Epsilon: 0.00
Episode 18700/100000, Avg Reward: 7.66, Epsilon: 0.00
Episode 18800/100000, Avg Reward: 8.00, Epsilon: 0.00
Episode 18900/100000, Avg Reward: 7.55, Epsilon: 0.00
Episode 19000/100000, Avg Reward: 7.99, Epsilon: 0.00
Episode 19100/100000, Avg Reward: 7.72, Epsilon: 0.00
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Episode 19400/100000, Avg Reward: 7.32, Epsilon: 0.00
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Episode 19600/100000, Avg Reward: 7.65, Epsilon: 0.00
Episode 19700/100000, Avg Reward: 7.73, Epsilon: 0.00
Episode 19800/100000, Avg Reward: 7.64, Epsilon: 0.00
Episode 19900/100000, Avg Reward: 8.08, Epsilon: 0.00
Episode 20000/100000, Avg Reward: 7.69, Epsilon: 0.00
Episode 20100/100000, Avg Reward: 7.58, Epsilon: 0.00
Episode 20200/100000, Avg Reward: 8.17, Epsilon: 0.00
Episode 20300/100000, Avg Reward: 7.98, Epsilon: 0.00
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Episode 20500/100000, Avg Reward: 7.96, Epsilon: 0.00
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Episode 20700/100000, Avg Reward: 7.73, Epsilon: 0.00
Episode 20800/100000, Avg Reward: 7.84, Epsilon: 0.00
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Episode 21200/100000, Avg Reward: 7.59, Epsilon: 0.00
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Episode 21400/100000, Avg Reward: 7.89, Epsilon: 0.00
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Episode 21600/100000, Avg Reward: 7.49, Epsilon: 0.00
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Episode 22300/100000, Avg Reward: 7.96, Epsilon: 0.00
Episode 22400/100000, Avg Reward: 7.79, Epsilon: 0.00
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Episode 22700/100000, Avg Reward: 8.19, Epsilon: 0.00
Episode 22800/100000, Avg Reward: 7.64, Epsilon: 0.00
Episode 22900/100000, Avg Reward: 7.89, Epsilon: 0.00
Episode 23000/100000, Avg Reward: 7.76, Epsilon: 0.00
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Episode 23300/100000, Avg Reward: 8.03, Epsilon: 0.00
Episode 23400/100000, Avg Reward: 7.91, Epsilon: 0.00
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Episode 23600/100000, Avg Reward: 7.86, Epsilon: 0.00
Episode 23700/100000, Avg Reward: 8.02, Epsilon: 0.00
Episode 23800/100000, Avg Reward: 8.03, Epsilon: 0.00
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Episode 23900/100000, Avg Reward: 7.37, Epsilon: 0.00
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Episode 24100/100000, Avg Reward: 7.74, Epsilon: 0.00
Episode 24200/100000, Avg Reward: 7.74, Epsilon: 0.00
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Episode 24700/100000, Avg Reward: 8.01, Epsilon: 0.00
Episode 24800/100000, Avg Reward: 7.91, Epsilon: 0.00
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Episode 25200/100000, Avg Reward: 7.39, Epsilon: 0.00
Episode 25300/100000, Avg Reward: 8.03, Epsilon: 0.00
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Episode 26300/100000, Avg Reward: 8.10, Epsilon: 0.00
Episode 26400/100000, Avg Reward: 7.97, Epsilon: 0.00
Episode 26500/100000, Avg Reward: 8.03, Epsilon: 0.00
Episode 26600/100000, Avg Reward: 7.86, Epsilon: 0.00
Episode 26700/100000, Avg Reward: 7.79, Epsilon: 0.00
Episode 26800/100000, Avg Reward: 7.80, Epsilon: 0.00
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Episode 27800/100000, Avg Reward: 7.69, Epsilon: 0.00
Episode 27900/100000, Avg Reward: 7.27, Epsilon: 0.00
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Episode 28400/100000, Avg Reward: 8.20, Epsilon: 0.00
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Episode 28700/100000, Avg Reward: 7.76, Epsilon: 0.00
Episode 28800/100000, Avg Reward: 8.03, Epsilon: 0.00
Episode 28900/100000, Avg Reward: 7.63, Epsilon: 0.00
Episode 29000/100000, Avg Reward: 7.81, Epsilon: 0.00
Episode 29100/100000, Avg Reward: 7.87, Epsilon: 0.00
Episode 29200/100000, Avg Reward: 8.05, Epsilon: 0.00
Episode 29300/100000, Avg Reward: 7.97, Epsilon: 0.00
Episode 29400/100000, Avg Reward: 8.20, Epsilon: 0.00
Episode 29500/100000, Avg Reward: 7.52, Epsilon: 0.00
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Episode 29600/100000, Avg Reward: 7.65, Epsilon: 0.00
Episode 29700/100000, Avg Reward: 7.49, Epsilon: 0.00
Episode 29800/100000, Avg Reward: 8.02, Epsilon: 0.00
Episode 29900/100000, Avg Reward: 7.99, Epsilon: 0.00
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Episode 30100/100000, Avg Reward: 7.92, Epsilon: 0.00
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Episode 30300/100000, Avg Reward: 7.88, Epsilon: 0.00
Episode 30400/100000, Avg Reward: 7.88, Epsilon: 0.00
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Episode 30700/100000, Avg Reward: 7.87, Epsilon: 0.00
Episode 30800/100000, Avg Reward: 7.84, Epsilon: 0.00
Episode 30900/100000, Avg Reward: 7.82, Epsilon: 0.00
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Episode 31800/100000, Avg Reward: 7.97, Epsilon: 0.00
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Episode 32900/100000, Avg Reward: 8.21, Epsilon: 0.00
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Episode 34200/100000, Avg Reward: 7.96, Epsilon: 0.00
Episode 34300/100000, Avg Reward: 7.69, Epsilon: 0.00
Episode 34400/100000, Avg Reward: 7.88, Epsilon: 0.00
Episode 34500/100000, Avg Reward: 8.27, Epsilon: 0.00
Episode 34600/100000, Avg Reward: 8.04, Epsilon: 0.00
Episode 34700/100000, Avg Reward: 7.79, Epsilon: 0.00
Episode 34800/100000, Avg Reward: 7.85, Epsilon: 0.00
Episode 34900/100000, Avg Reward: 7.87, Epsilon: 0.00
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Episode 35100/100000, Avg Reward: 7.76, Epsilon: 0.00
Episode 35200/100000, Avg Reward: 7.64, Epsilon: 0.00
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Episode 35300/100000, Avg Reward: 7.98, Epsilon: 0.00
Episode 35400/100000, Avg Reward: 8.08, Epsilon: 0.00
Episode 35500/100000, Avg Reward: 7.94, Epsilon: 0.00
Episode 35600/100000, Avg Reward: 7.88, Epsilon: 0.00
Episode 35700/100000, Avg Reward: 7.65, Epsilon: 0.00
Episode 35800/100000, Avg Reward: 8.04, Epsilon: 0.00
Episode 35900/100000, Avg Reward: 7.98, Epsilon: 0.00
Episode 36000/100000, Avg Reward: 7.87, Epsilon: 0.00
Episode 36100/100000, Avg Reward: 7.86, Epsilon: 0.00
Episode 36200/100000, Avg Reward: 8.35, Epsilon: 0.00
Episode 36300/100000, Avg Reward: 7.45, Epsilon: 0.00
Episode 36400/100000, Avg Reward: 7.65, Epsilon: 0.00
Episode 36500/100000, Avg Reward: 7.78, Epsilon: 0.00
Episode 36600/100000, Avg Reward: 8.66, Epsilon: 0.00
Episode 36700/100000, Avg Reward: 7.67, Epsilon: 0.00
Episode 36800/100000, Avg Reward: 7.45, Epsilon: 0.00
Episode 36900/100000, Avg Reward: 7.67, Epsilon: 0.00
Episode 37000/100000, Avg Reward: 7.92, Epsilon: 0.00
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Episode 37300/100000, Avg Reward: 7.86, Epsilon: 0.00
Episode 37400/100000, Avg Reward: 7.77, Epsilon: 0.00
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Episode 37900/100000, Avg Reward: 8.68, Epsilon: 0.00
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Episode 38100/100000, Avg Reward: 7.74, Epsilon: 0.00
Episode 38200/100000, Avg Reward: 7.97, Epsilon: 0.00
Episode 38300/100000, Avg Reward: 7.37, Epsilon: 0.00
Episode 38400/100000, Avg Reward: 7.92, Epsilon: 0.00
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Episode 38600/100000, Avg Reward: 7.58, Epsilon: 0.00
Episode 38700/100000, Avg Reward: 8.23, Epsilon: 0.00
Episode 38800/100000, Avg Reward: 7.62, Epsilon: 0.00
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Episode 39000/100000, Avg Reward: 7.39, Epsilon: 0.00
Episode 39100/100000, Avg Reward: 7.54, Epsilon: 0.00
Episode 39200/100000, Avg Reward: 7.92, Epsilon: 0.00
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Episode 39500/100000, Avg Reward: 7.68, Epsilon: 0.00
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Episode 40100/100000, Avg Reward: 8.12, Epsilon: 0.00
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Episode 40500/100000, Avg Reward: 7.77, Epsilon: 0.00
Episode 40600/100000, Avg Reward: 8.23, Epsilon: 0.00
Episode 40700/100000, Avg Reward: 7.97, Epsilon: 0.00
Episode 40800/100000, Avg Reward: 7.81, Epsilon: 0.00
Episode 40900/100000, Avg Reward: 7.79, Epsilon: 0.00
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Episode 41000/100000, Avg Reward: 7.89, Epsilon: 0.00
Episode 41100/100000, Avg Reward: 7.37, Epsilon: 0.00
Episode 41200/100000, Avg Reward: 7.94, Epsilon: 0.00
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Episode 41600/100000, Avg Reward: 7.70, Epsilon: 0.00
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Episode 42200/100000, Avg Reward: 7.98, Epsilon: 0.00
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Episode 46600/100000, Avg Reward: 8.31, Epsilon: 0.00
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Episode 52300/100000, Avg Reward: 7.86, Epsilon: 0.00
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Episode 74700/100000, Avg Reward: 7.73, Epsilon: 0.00
Episode 74800/100000, Avg Reward: 7.87, Epsilon: 0.00
Episode 74900/100000, Avg Reward: 7.81, Epsilon: 0.00
Episode 75000/100000, Avg Reward: 7.47, Epsilon: 0.00
Episode 75100/100000, Avg Reward: 8.36, Epsilon: 0.00
```

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Episode 75200/100000, Avg Reward: 7.96, Epsilon: 0.00
Episode 75300/100000, Avg Reward: 7.69, Epsilon: 0.00
Episode 75400/100000, Avg Reward: 7.79, Epsilon: 0.00
Episode 75500/100000, Avg Reward: 8.14, Epsilon: 0.00
Episode 75600/100000, Avg Reward: 7.62, Epsilon: 0.00
Episode 75700/100000, Avg Reward: 8.10, Epsilon: 0.00
Episode 75800/100000, Avg Reward: 8.00, Epsilon: 0.00
Episode 75900/100000, Avg Reward: 8.03, Epsilon: 0.00
Episode 76000/100000, Avg Reward: 7.65, Epsilon: 0.00
Episode 76100/100000, Avg Reward: 7.89, Epsilon: 0.00
Episode 76200/100000, Avg Reward: 7.84, Epsilon: 0.00
Episode 76300/100000, Avg Reward: 8.36, Epsilon: 0.00
Episode 76400/100000, Avg Reward: 7.83, Epsilon: 0.00
Episode 76500/100000, Avg Reward: 8.27, Epsilon: 0.00
Episode 76600/100000, Avg Reward: 8.20, Epsilon: 0.00
Episode 76700/100000, Avg Reward: 7.65, Epsilon: 0.00
Episode 76800/100000, Avg Reward: 8.20, Epsilon: 0.00
Episode 76900/100000, Avg Reward: 7.90, Epsilon: 0.00
Episode 77000/100000, Avg Reward: 8.21, Epsilon: 0.00
Episode 77100/100000, Avg Reward: 8.17, Epsilon: 0.00
Episode 77200/100000, Avg Reward: 7.91, Epsilon: 0.00
Episode 77300/100000, Avg Reward: 7.45, Epsilon: 0.00
Episode 77400/100000, Avg Reward: 8.37, Epsilon: 0.00
Episode 77500/100000, Avg Reward: 7.97, Epsilon: 0.00
Episode 77600/100000, Avg Reward: 7.91, Epsilon: 0.00
Episode 77700/100000, Avg Reward: 7.94, Epsilon: 0.00
Episode 77800/100000, Avg Reward: 8.04, Epsilon: 0.00
Episode 77900/100000, Avg Reward: 8.16, Epsilon: 0.00
Episode 78000/100000, Avg Reward: 8.18, Epsilon: 0.00
Episode 78100/100000, Avg Reward: 7.30, Epsilon: 0.00
Episode 78200/100000, Avg Reward: 7.91, Epsilon: 0.00
Episode 78300/100000, Avg Reward: 7.88, Epsilon: 0.00
Episode 78400/100000, Avg Reward: 7.67, Epsilon: 0.00
Episode 78500/100000, Avg Reward: 8.20, Epsilon: 0.00
Episode 78600/100000, Avg Reward: 7.58, Epsilon: 0.00
Episode 78700/100000, Avg Reward: 8.12, Epsilon: 0.00
Episode 78800/100000, Avg Reward: 8.43, Epsilon: 0.00
Episode 78900/100000, Avg Reward: 8.19, Epsilon: 0.00
Episode 79000/100000, Avg Reward: 8.45, Epsilon: 0.00
Episode 79100/100000, Avg Reward: 7.71, Epsilon: 0.00
Episode 79200/100000, Avg Reward: 7.77, Epsilon: 0.00
Episode 79300/100000, Avg Reward: 8.09, Epsilon: 0.00
Episode 79400/100000, Avg Reward: 8.01, Epsilon: 0.00
Episode 79500/100000, Avg Reward: 7.74, Epsilon: 0.00
Episode 79600/100000, Avg Reward: 7.98, Epsilon: 0.00
Episode 79700/100000, Avg Reward: 7.72, Epsilon: 0.00
Episode 79800/100000, Avg Reward: 7.95, Epsilon: 0.00
Episode 79900/100000, Avg Reward: 8.22, Epsilon: 0.00
Episode 80000/100000, Avg Reward: 7.85, Epsilon: 0.00
Episode 80100/100000, Avg Reward: 7.90, Epsilon: 0.00
Episode 80200/100000, Avg Reward: 8.02, Epsilon: 0.00
Episode 80300/100000, Avg Reward: 7.68, Epsilon: 0.00
Episode 80400/100000, Avg Reward: 8.17, Epsilon: 0.00
Episode 80500/100000, Avg Reward: 7.80, Epsilon: 0.00
Episode 80600/100000, Avg Reward: 8.11, Epsilon: 0.00
Episode 80700/100000, Avg Reward: 8.09, Epsilon: 0.00
Episode 80800/100000, Avg Reward: 8.23, Epsilon: 0.00
```

```
Episode 80900/100000, Avg Reward: 8.07, Epsilon: 0.00
Episode 81000/100000, Avg Reward: 7.75, Epsilon: 0.00
Episode 81100/100000, Avg Reward: 7.55, Epsilon: 0.00
Episode 81200/100000, Avg Reward: 7.98, Epsilon: 0.00
Episode 81300/100000, Avg Reward: 7.47, Epsilon: 0.00
Episode 81400/100000, Avg Reward: 7.80, Epsilon: 0.00
Episode 81500/100000, Avg Reward: 8.01, Epsilon: 0.00
Episode 81600/100000, Avg Reward: 8.10, Epsilon: 0.00
Episode 81700/100000, Avg Reward: 7.89, Epsilon: 0.00
Episode 81800/100000, Avg Reward: 8.20, Epsilon: 0.00
Episode 81900/100000, Avg Reward: 7.65, Epsilon: 0.00
Episode 82000/100000, Avg Reward: 7.95, Epsilon: 0.00
Episode 82100/100000, Avg Reward: 7.82, Epsilon: 0.00
Episode 82200/100000, Avg Reward: 7.99, Epsilon: 0.00
Episode 82300/100000, Avg Reward: 8.37, Epsilon: 0.00
Episode 82400/100000, Avg Reward: 7.92, Epsilon: 0.00
Episode 82500/100000, Avg Reward: 7.68, Epsilon: 0.00
Episode 82600/100000, Avg Reward: 8.30, Epsilon: 0.00
Episode 82700/100000, Avg Reward: 8.15, Epsilon: 0.00
Episode 82800/100000, Avg Reward: 7.97, Epsilon: 0.00
Episode 82900/100000, Avg Reward: 8.63, Epsilon: 0.00
Episode 83000/100000, Avg Reward: 7.71, Epsilon: 0.00
Episode 83100/100000, Avg Reward: 7.91, Epsilon: 0.00
Episode 83200/100000, Avg Reward: 7.72, Epsilon: 0.00
Episode 83300/100000, Avg Reward: 8.23, Epsilon: 0.00
Episode 83400/100000, Avg Reward: 7.60, Epsilon: 0.00
Episode 83500/100000, Avg Reward: 7.83, Epsilon: 0.00
Episode 83600/100000, Avg Reward: 7.97, Epsilon: 0.00
Episode 83700/100000, Avg Reward: 7.59, Epsilon: 0.00
Episode 83800/100000, Avg Reward: 8.18, Epsilon: 0.00
Episode 83900/100000, Avg Reward: 8.03, Epsilon: 0.00
Episode 84000/100000, Avg Reward: 7.88, Epsilon: 0.00
Episode 84100/100000, Avg Reward: 8.14, Epsilon: 0.00
Episode 84200/100000, Avg Reward: 8.22, Epsilon: 0.00
Episode 84300/100000, Avg Reward: 7.50, Epsilon: 0.00
Episode 84400/100000, Avg Reward: 8.35, Epsilon: 0.00
Episode 84500/100000, Avg Reward: 8.18, Epsilon: 0.00
Episode 84600/100000, Avg Reward: 7.59, Epsilon: 0.00
Episode 84700/100000, Avg Reward: 7.85, Epsilon: 0.00
Episode 84800/100000, Avg Reward: 8.10, Epsilon: 0.00
Episode 84900/100000, Avg Reward: 7.74, Epsilon: 0.00
Episode 85000/100000, Avg Reward: 7.61, Epsilon: 0.00
Episode 85100/100000, Avg Reward: 7.95, Epsilon: 0.00
Episode 85200/100000, Avg Reward: 7.49, Epsilon: 0.00
Episode 85300/100000, Avg Reward: 7.89, Epsilon: 0.00
Episode 85400/100000, Avg Reward: 7.80, Epsilon: 0.00
Episode 85500/100000, Avg Reward: 8.06, Epsilon: 0.00
Episode 85600/100000, Avg Reward: 7.38, Epsilon: 0.00
Episode 85700/100000, Avg Reward: 8.11, Epsilon: 0.00
Episode 85800/100000, Avg Reward: 7.97, Epsilon: 0.00
Episode 85900/100000, Avg Reward: 8.06, Epsilon: 0.00
Episode 86000/100000, Avg Reward: 7.78, Epsilon: 0.00
Episode 86100/100000, Avg Reward: 8.08, Epsilon: 0.00
Episode 86200/100000, Avg Reward: 8.03, Epsilon: 0.00
Episode 86300/100000, Avg Reward: 7.89, Epsilon: 0.00
Episode 86400/100000, Avg Reward: 8.17, Epsilon: 0.00
Episode 86500/100000, Avg Reward: 7.61, Epsilon: 0.00
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Episode 86600/100000, Avg Reward: 8.41, Epsilon: 0.00
Episode 86700/100000, Avg Reward: 8.09, Epsilon: 0.00
Episode 86800/100000, Avg Reward: 7.83, Epsilon: 0.00
Episode 86900/100000, Avg Reward: 7.83, Epsilon: 0.00
Episode 87000/100000, Avg Reward: 7.63, Epsilon: 0.00
Episode 87100/100000, Avg Reward: 7.90, Epsilon: 0.00
Episode 87200/100000, Avg Reward: 7.77, Epsilon: 0.00
Episode 87300/100000, Avg Reward: 7.91, Epsilon: 0.00
Episode 87400/100000, Avg Reward: 7.75, Epsilon: 0.00
Episode 87500/100000, Avg Reward: 8.33, Epsilon: 0.00
Episode 87600/100000, Avg Reward: 7.86, Epsilon: 0.00
Episode 87700/100000, Avg Reward: 7.74, Epsilon: 0.00
Episode 87800/100000, Avg Reward: 7.88, Epsilon: 0.00
Episode 87900/100000, Avg Reward: 7.69, Epsilon: 0.00
Episode 88000/100000, Avg Reward: 8.04, Epsilon: 0.00
Episode 88100/100000, Avg Reward: 8.08, Epsilon: 0.00
Episode 88200/100000, Avg Reward: 8.03, Epsilon: 0.00
Episode 88300/100000, Avg Reward: 7.63, Epsilon: 0.00
Episode 88400/100000, Avg Reward: 8.27, Epsilon: 0.00
Episode 88500/100000, Avg Reward: 7.90, Epsilon: 0.00
Episode 88600/100000, Avg Reward: 8.14, Epsilon: 0.00
Episode 88700/100000, Avg Reward: 7.80, Epsilon: 0.00
Episode 88800/100000, Avg Reward: 8.29, Epsilon: 0.00
Episode 88900/100000, Avg Reward: 8.25, Epsilon: 0.00
Episode 89000/100000, Avg Reward: 7.84, Epsilon: 0.00
Episode 89100/100000, Avg Reward: 8.14, Epsilon: 0.00
Episode 89200/100000, Avg Reward: 8.24, Epsilon: 0.00
Episode 89300/100000, Avg Reward: 8.32, Epsilon: 0.00
Episode 89400/100000, Avg Reward: 7.81, Epsilon: 0.00
Episode 89500/100000, Avg Reward: 7.98, Epsilon: 0.00
Episode 89600/100000, Avg Reward: 7.77, Epsilon: 0.00
Episode 89700/100000, Avg Reward: 7.81, Epsilon: 0.00
Episode 89800/100000, Avg Reward: 7.77, Epsilon: 0.00
Episode 89900/100000, Avg Reward: 7.67, Epsilon: 0.00
Episode 90000/100000, Avg Reward: 7.69, Epsilon: 0.00
Episode 90100/100000, Avg Reward: 7.48, Epsilon: 0.00
Episode 90200/100000, Avg Reward: 7.63, Epsilon: 0.00
Episode 90300/100000, Avg Reward: 8.02, Epsilon: 0.00
Episode 90400/100000, Avg Reward: 8.21, Epsilon: 0.00
Episode 90500/100000, Avg Reward: 8.22, Epsilon: 0.00
Episode 90600/100000, Avg Reward: 7.95, Epsilon: 0.00
Episode 90700/100000, Avg Reward: 7.77, Epsilon: 0.00
Episode 90800/100000, Avg Reward: 7.99, Epsilon: 0.00
Episode 90900/100000, Avg Reward: 8.11, Epsilon: 0.00
Episode 91000/100000, Avg Reward: 8.11, Epsilon: 0.00
Episode 91100/100000, Avg Reward: 8.05, Epsilon: 0.00
Episode 91200/100000, Avg Reward: 7.65, Epsilon: 0.00
Episode 91300/100000, Avg Reward: 7.71, Epsilon: 0.00
Episode 91400/100000, Avg Reward: 7.69, Epsilon: 0.00
Episode 91500/100000, Avg Reward: 7.79, Epsilon: 0.00
Episode 91600/100000, Avg Reward: 7.62, Epsilon: 0.00
Episode 91700/100000, Avg Reward: 8.24, Epsilon: 0.00
Episode 91800/100000, Avg Reward: 7.59, Epsilon: 0.00
Episode 91900/100000, Avg Reward: 7.23, Epsilon: 0.00
Episode 92000/100000, Avg Reward: 7.56, Epsilon: 0.00
Episode 92100/100000, Avg Reward: 7.67, Epsilon: 0.00
Episode 92200/100000, Avg Reward: 8.00, Epsilon: 0.00
```

```
Episode 92300/100000, Avg Reward: 7.61, Epsilon: 0.00
Episode 92400/100000, Avg Reward: 7.52, Epsilon: 0.00
Episode 92500/100000, Avg Reward: 7.45, Epsilon: 0.00
Episode 92600/100000, Avg Reward: 7.60, Epsilon: 0.00
Episode 92700/100000, Avg Reward: 8.01, Epsilon: 0.00
Episode 92800/100000, Avg Reward: 7.83, Epsilon: 0.00
Episode 92900/100000, Avg Reward: 8.40, Epsilon: 0.00
Episode 93000/100000, Avg Reward: 8.14, Epsilon: 0.00
Episode 93100/100000, Avg Reward: 7.84, Epsilon: 0.00
Episode 93200/100000, Avg Reward: 8.52, Epsilon: 0.00
Episode 93300/100000, Avg Reward: 7.99, Epsilon: 0.00
Episode 93400/100000, Avg Reward: 7.70, Epsilon: 0.00
Episode 93500/100000, Avg Reward: 7.92, Epsilon: 0.00
Episode 93600/100000, Avg Reward: 7.59, Epsilon: 0.00
Episode 93700/100000, Avg Reward: 7.80, Epsilon: 0.00
Episode 93800/100000, Avg Reward: 7.46, Epsilon: 0.00
Episode 93900/100000, Avg Reward: 7.70, Epsilon: 0.00
Episode 94000/100000, Avg Reward: 7.92, Epsilon: 0.00
Episode 94100/100000, Avg Reward: 7.63, Epsilon: 0.00
Episode 94200/100000, Avg Reward: 8.21, Epsilon: 0.00
Episode 94300/100000, Avg Reward: 7.81, Epsilon: 0.00
Episode 94400/100000, Avg Reward: 7.84, Epsilon: 0.00
Episode 94500/100000, Avg Reward: 7.81, Epsilon: 0.00
Episode 94600/100000, Avg Reward: 8.30, Epsilon: 0.00
Episode 94700/100000, Avg Reward: 7.60, Epsilon: 0.00
Episode 94800/100000, Avg Reward: 7.79, Epsilon: 0.00
Episode 94900/100000, Avg Reward: 7.47, Epsilon: 0.00
Episode 95000/100000, Avg Reward: 7.74, Epsilon: 0.00
Episode 95100/100000, Avg Reward: 7.84, Epsilon: 0.00
Episode 95200/100000, Avg Reward: 8.00, Epsilon: 0.00
Episode 95300/100000, Avg Reward: 8.20, Epsilon: 0.00
Episode 95400/100000, Avg Reward: 7.87, Epsilon: 0.00
Episode 95500/100000, Avg Reward: 8.15, Epsilon: 0.00
Episode 95600/100000, Avg Reward: 7.96, Epsilon: 0.00
Episode 95700/100000, Avg Reward: 8.13, Epsilon: 0.00
Episode 95800/100000, Avg Reward: 7.97, Epsilon: 0.00
Episode 95900/100000, Avg Reward: 7.75, Epsilon: 0.00
Episode 96000/100000, Avg Reward: 7.73, Epsilon: 0.00
Episode 96100/100000, Avg Reward: 7.68, Epsilon: 0.00
Episode 96200/100000, Avg Reward: 8.58, Epsilon: 0.00
Episode 96300/100000, Avg Reward: 7.77, Epsilon: 0.00
Episode 96400/100000, Avg Reward: 7.90, Epsilon: 0.00
Episode 96500/100000, Avg Reward: 7.39, Epsilon: 0.00
Episode 96600/100000, Avg Reward: 8.03, Epsilon: 0.00
Episode 96700/100000, Avg Reward: 7.85, Epsilon: 0.00
Episode 96800/100000, Avg Reward: 7.40, Epsilon: 0.00
Episode 96900/100000, Avg Reward: 8.18, Epsilon: 0.00
Episode 97000/100000, Avg Reward: 7.67, Epsilon: 0.00
Episode 97100/100000, Avg Reward: 7.24, Epsilon: 0.00
Episode 97200/100000, Avg Reward: 7.81, Epsilon: 0.00
Episode 97300/100000, Avg Reward: 8.24, Epsilon: 0.00
Episode 97400/100000, Avg Reward: 8.35, Epsilon: 0.00
Episode 97500/100000, Avg Reward: 7.88, Epsilon: 0.00
Episode 97600/100000, Avg Reward: 7.95, Epsilon: 0.00
Episode 97700/100000, Avg Reward: 7.66, Epsilon: 0.00
Episode 97800/100000, Avg Reward: 7.80, Epsilon: 0.00
Episode 97900/100000, Avg Reward: 8.09, Epsilon: 0.00
```

```
Episode 98000/100000, Avg Reward: 8.55, Epsilon: 0.00
Episode 98100/100000, Avg Reward: 7.95, Epsilon: 0.00
Episode 98200/100000, Avg Reward: 7.70, Epsilon: 0.00
Episode 98300/100000, Avg Reward: 7.63, Epsilon: 0.00
Episode 98400/100000, Avg Reward: 8.27, Epsilon: 0.00
Episode 98500/100000, Avg Reward: 8.02, Epsilon: 0.00
Episode 98600/100000, Avg Reward: 7.74, Epsilon: 0.00
Episode 98700/100000, Avg Reward: 8.24, Epsilon: 0.00
Episode 98800/100000, Avg Reward: 7.84, Epsilon: 0.00
Episode 98900/100000, Avg Reward: 8.44, Epsilon: 0.00
Episode 99000/100000, Avg Reward: 8.32, Epsilon: 0.00
Episode 99100/100000, Avg Reward: 8.48, Epsilon: 0.00
Episode 99200/100000, Avg Reward: 7.75, Epsilon: 0.00
Episode 99300/100000, Avg Reward: 8.53, Epsilon: 0.00
Episode 99400/100000, Avg Reward: 7.49, Epsilon: 0.00
Episode 99500/100000, Avg Reward: 7.93, Epsilon: 0.00
Episode 99600/100000, Avg Reward: 7.53, Epsilon: 0.00
Episode 99700/100000, Avg Reward: 7.62, Epsilon: 0.00
Episode 99800/100000, Avg Reward: 8.18, Epsilon: 0.00
Episode 99900/100000, Avg Reward: 8.19, Epsilon: 0.00
Episode 100000/100000, Avg Reward: 8.13, Epsilon: 0.00
CPU times: user 11.9 s, sys: 538 ms, total: 12.4 s
Wall time: 11.7 s
```
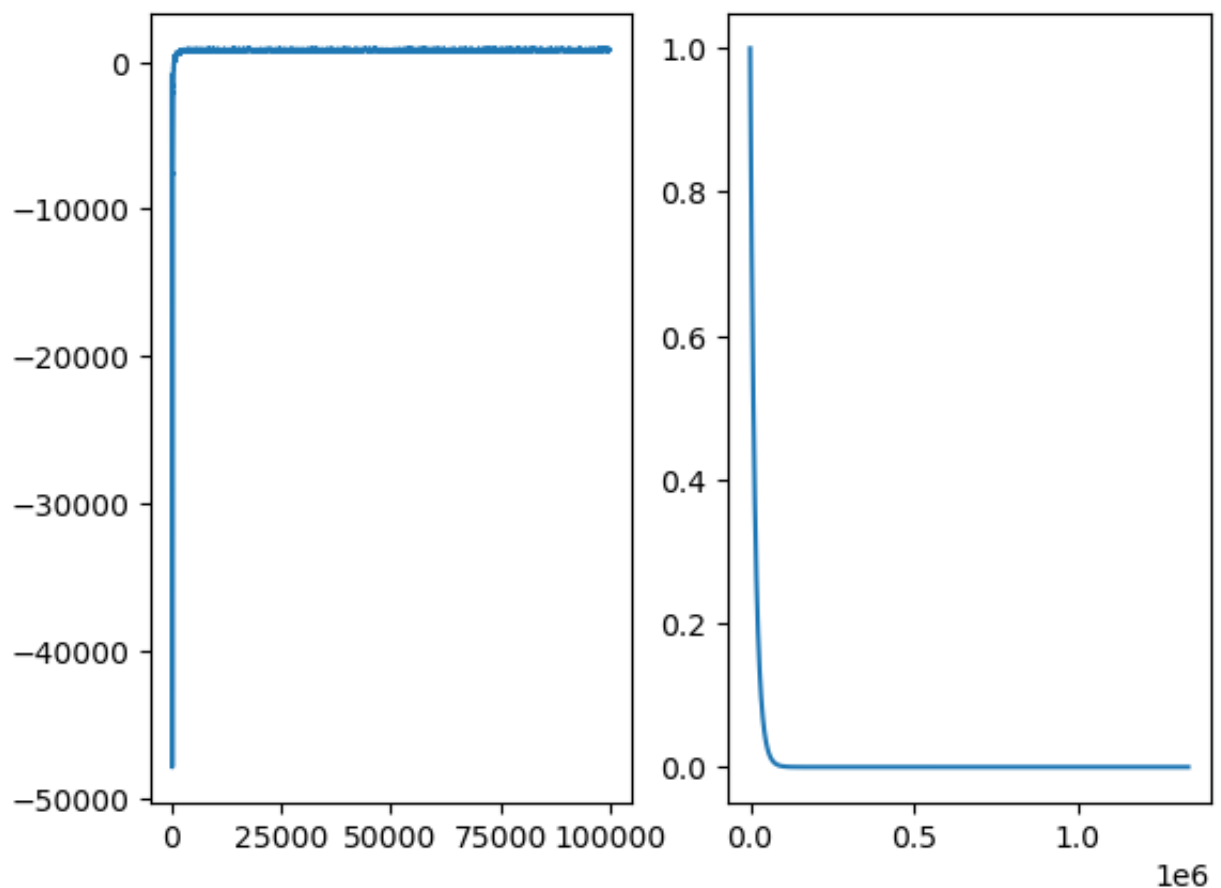

In [84]: `print(my_q_agent_controlled_training_rewards)`

```
[-776. -884. -767. ...    7.    8.    9.]
```

DQN Agent with Controlled Parameters

In [33]: `my_dqn_agent_controlled = DQNAgent(game_id="Taxi-v3", gamma=0.95, alpha=0`
         `                                 epsilon_start=1.0, epsilon_decay=1000,`

```
                                                    max_steps=200, render_mode="rgb_array"
```

In [92]:
```
%%time
my_dqn_agent_controlled_training_rewards = my_dqn_agent_controlled.train(
```

Policy (policy network model before training with randomly initialized val
ues):
State 000, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.04]
State 001, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.01 -0.04]
State 002, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.05]
State 003, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
State 004, Action E, Q-values: [+0.06 -0.03 +0.09 -0.02 +0.02 -0.05]
State 005, Action E, Q-values: [+0.05 -0.02 +0.10 -0.01 +0.01 -0.05]
State 006, Action E, Q-values: [+0.04 -0.03 +0.10 -0.02 +0.01 -0.04]
State 007, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 008, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.04]
State 009, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 010, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.05]
State 011, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.01 -0.05]
State 012, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.06]
State 013, Action E, Q-values: [+0.05 -0.03 +0.08 -0.02 +0.02 -0.05]
State 014, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.05]
State 015, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.03 -0.05]
State 016, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.06]
State 017, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 018, Action E, Q-values: [+0.05 -0.03 +0.10 -0.03 +0.02 -0.05]
State 019, Action E, Q-values: [+0.06 -0.03 +0.10 -0.02 +0.02 -0.05]
State 020, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.05]
State 021, Action E, Q-values: [+0.06 -0.03 +0.09 -0.02 +0.02 -0.05]
State 022, Action E, Q-values: [+0.05 -0.02 +0.10 -0.02 +0.01 -0.05]
State 023, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.05]
State 024, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.05]
State 025, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.05]
State 026, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.01 -0.04]
State 027, Action E, Q-values: [+0.04 -0.03 +0.10 -0.02 +0.02 -0.05]
State 028, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.04]
State 029, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.05]
State 030, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.06]
State 031, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.04]
State 032, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.03 -0.05]
State 033, Action E, Q-values: [+0.05 -0.03 +0.09 -0.03 +0.02 -0.05]
State 034, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
State 035, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 036, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 037, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.01 -0.05]
State 038, Action E, Q-values: [+0.06 -0.03 +0.09 -0.02 +0.02 -0.05]
State 039, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.05]
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State 041, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
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State 043, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 044, Action E, Q-values: [+0.05 -0.04 +0.09 -0.03 +0.02 -0.05]
State 045, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 046, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.04]
State 047, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.05]
State 048, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 049, Action E, Q-values: [+0.05 -0.04 +0.10 -0.02 +0.02 -0.04]

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State 050, Action E, Q-values: [+0.05 -0.02 +0.10 -0.02 +0.02 -0.05]
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State 052, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.05]
State 053, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.05]
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State 055, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.04]
State 056, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 057, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.06]
State 058, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.06]
State 059, Action E, Q-values: [+0.05 -0.02 +0.09 -0.02 +0.02 -0.05]
State 060, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.05]
State 061, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.05]
State 062, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
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State 064, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.04]
State 065, Action E, Q-values: [+0.04 -0.03 +0.10 -0.02 +0.02 -0.05]
State 066, Action E, Q-values: [+0.04 -0.03 +0.09 -0.03 +0.02 -0.04]
State 067, Action E, Q-values: [+0.04 -0.03 +0.10 -0.01 +0.02 -0.04]
State 068, Action E, Q-values: [+0.05 -0.03 +0.09 -0.03 +0.02 -0.05]
State 069, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.05]
State 070, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.04]
State 071, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.04]
State 072, Action E, Q-values: [+0.05 -0.02 +0.10 -0.01 +0.02 -0.05]
State 073, Action E, Q-values: [+0.05 -0.02 +0.09 -0.02 +0.01 -0.04]
State 074, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.05]
State 075, Action E, Q-values: [+0.05 -0.02 +0.10 -0.01 +0.02 -0.04]
State 076, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.01 -0.04]
State 077, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.05]
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State 079, Action E, Q-values: [+0.06 -0.03 +0.10 -0.02 +0.01 -0.04]
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State 081, Action E, Q-values: [+0.05 -0.04 +0.09 -0.02 +0.01 -0.04]
State 082, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.05]
State 083, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 084, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.05]
State 085, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
State 086, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.05]
State 087, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 088, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.05]
State 089, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.01 -0.06]
State 090, Action E, Q-values: [+0.04 -0.03 +0.09 -0.01 +0.02 -0.05]
State 091, Action E, Q-values: [+0.04 -0.03 +0.10 -0.03 +0.02 -0.05]
State 092, Action E, Q-values: [+0.04 -0.03 +0.10 -0.02 +0.02 -0.04]
State 093, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 094, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
State 095, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 096, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 097, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.06]
State 098, Action E, Q-values: [+0.05 -0.04 +0.10 -0.02 +0.02 -0.04]
State 099, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.05]
State 100, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.05]
State 101, Action E, Q-values: [+0.05 -0.02 +0.10 -0.01 +0.02 -0.04]
State 102, Action E, Q-values: [+0.05 -0.02 +0.10 -0.01 +0.02 -0.05]
State 103, Action E, Q-values: [+0.04 -0.02 +0.09 -0.02 +0.02 -0.04]
State 104, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
State 105, Action E, Q-values: [+0.06 -0.03 +0.09 -0.02 +0.02 -0.05]
State 106, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
```

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State 107, Action E, Q-values: [+0.06 -0.03 +0.09 -0.02 +0.01 -0.05]
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State 110, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.01 -0.06]
State 111, Action E, Q-values: [+0.06 -0.03 +0.09 -0.01 +0.01 -0.05]
State 112, Action E, Q-values: [+0.05 -0.03 +0.09 -0.03 +0.01 -0.05]
State 113, Action E, Q-values: [+0.05 -0.03 +0.10 -0.03 +0.02 -0.04]
State 114, Action E, Q-values: [+0.05 -0.02 +0.09 -0.02 +0.02 -0.05]
State 115, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 116, Action E, Q-values: [+0.05 -0.03 +0.10 -0.01 +0.02 -0.04]
State 117, Action E, Q-values: [+0.06 -0.03 +0.09 -0.01 +0.01 -0.05]
State 118, Action E, Q-values: [+0.05 -0.02 +0.09 -0.02 +0.01 -0.04]
State 119, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.03 -0.05]
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State 122, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.03 -0.05]
State 123, Action E, Q-values: [+0.06 -0.03 +0.10 -0.01 +0.02 -0.05]
State 124, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.05]
State 125, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.01 -0.05]
State 126, Action E, Q-values: [+0.05 -0.02 +0.10 -0.02 +0.02 -0.05]
State 127, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.01 -0.04]
State 128, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.05]
State 129, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.05]
State 130, Action E, Q-values: [+0.04 -0.03 +0.10 -0.02 +0.02 -0.04]
State 131, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
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State 133, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
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State 135, Action E, Q-values: [+0.04 -0.02 +0.09 -0.02 +0.02 -0.05]
State 136, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.05]
State 137, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
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State 139, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.04]
State 140, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.01 -0.05]
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State 143, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.06]
State 144, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
State 145, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.05]
State 146, Action E, Q-values: [+0.05 -0.03 +0.09 -0.03 +0.02 -0.06]
State 147, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.01 -0.05]
State 148, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.04]
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State 153, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.01 -0.05]
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State 155, Action E, Q-values: [+0.05 -0.03 +0.10 -0.01 +0.02 -0.05]
State 156, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.05]
State 157, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.06]
State 158, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.04]
State 159, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
State 160, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.01 -0.05]
State 161, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.05]
State 162, Action E, Q-values: [+0.05 -0.02 +0.10 -0.02 +0.02 -0.05]
State 163, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
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State 167, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.04]
State 168, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.05]
State 169, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.05]
State 170, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.04]
State 171, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 172, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.01 -0.05]
State 173, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
State 174, Action E, Q-values: [+0.05 -0.02 +0.09 -0.02 +0.02 -0.06]
State 175, Action E, Q-values: [+0.04 -0.03 +0.10 -0.03 +0.02 -0.04]
State 176, Action E, Q-values: [+0.04 -0.03 +0.10 -0.03 +0.02 -0.06]
State 177, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 178, Action E, Q-values: [+0.05 -0.03 +0.10 -0.01 +0.02 -0.05]
State 179, Action E, Q-values: [+0.05 -0.04 +0.09 -0.02 +0.02 -0.04]
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State 184, Action E, Q-values: [+0.05 -0.02 +0.10 -0.02 +0.02 -0.05]
State 185, Action E, Q-values: [+0.05 -0.03 +0.09 -0.03 +0.02 -0.05]
State 186, Action E, Q-values: [+0.05 -0.02 +0.09 -0.02 +0.01 -0.04]
State 187, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 188, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 189, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.04]
State 190, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 191, Action E, Q-values: [+0.05 -0.02 +0.10 -0.01 +0.02 -0.04]
State 192, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.01 -0.04]
State 193, Action E, Q-values: [+0.05 -0.02 +0.10 -0.02 +0.02 -0.05]
State 194, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 195, Action E, Q-values: [+0.05 -0.02 +0.09 -0.02 +0.01 -0.05]
State 196, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.04]
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State 204, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.05]
State 205, Action E, Q-values: [+0.06 -0.03 +0.10 -0.01 +0.01 -0.05]
State 206, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.04]
State 207, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.05]
State 208, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.04]
State 209, Action E, Q-values: [+0.04 -0.03 +0.10 -0.02 +0.03 -0.05]
State 210, Action E, Q-values: [+0.05 -0.03 +0.09 -0.03 +0.02 -0.04]
State 211, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
State 212, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 213, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.05]
State 214, Action E, Q-values: [+0.05 -0.02 +0.09 -0.01 +0.02 -0.05]
State 215, Action E, Q-values: [+0.04 -0.02 +0.10 -0.02 +0.02 -0.04]
State 216, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.05]
State 217, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 218, Action E, Q-values: [+0.05 -0.04 +0.09 -0.02 +0.02 -0.05]
State 219, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.04]
State 220, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.04]
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State 221, Action E, Q-values: [+0.05 -0.04 +0.09 -0.02 +0.02 -0.04]
State 222, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.01 -0.05]
State 223, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.06]
State 224, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.05]
State 225, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.05]
State 226, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.01 -0.05]
State 227, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 228, Action E, Q-values: [+0.05 -0.02 +0.10 -0.01 +0.02 -0.05]
State 229, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.05]
State 230, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
State 231, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.05]
State 232, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.04]
State 233, Action E, Q-values: [+0.05 -0.02 +0.10 -0.01 +0.02 -0.04]
State 234, Action E, Q-values: [+0.04 -0.04 +0.10 -0.03 +0.02 -0.05]
State 235, Action E, Q-values: [+0.05 -0.02 +0.09 -0.02 +0.02 -0.04]
State 236, Action E, Q-values: [+0.05 -0.02 +0.10 -0.02 +0.02 -0.04]
State 237, Action E, Q-values: [+0.04 -0.03 +0.10 -0.02 +0.02 -0.04]
State 238, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.04]
State 239, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.01 -0.05]
State 240, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.05]
State 241, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.05]
State 242, Action E, Q-values: [+0.05 -0.03 +0.09 -0.03 +0.02 -0.04]
State 243, Action E, Q-values: [+0.05 -0.02 +0.09 -0.01 +0.02 -0.04]
State 244, Action E, Q-values: [+0.06 -0.02 +0.09 -0.02 +0.01 -0.06]
State 245, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.05]
State 246, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.05]
State 247, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.05]
State 248, Action E, Q-values: [+0.05 -0.02 +0.09 -0.02 +0.02 -0.05]
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State 252, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.01 -0.04]
State 253, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.05]
State 254, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
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State 256, Action E, Q-values: [+0.04 -0.03 +0.10 -0.03 +0.02 -0.05]
State 257, Action E, Q-values: [+0.05 -0.02 +0.10 -0.02 +0.02 -0.04]
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State 261, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 262, Action E, Q-values: [+0.05 -0.03 +0.10 -0.01 +0.02 -0.05]
State 263, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.04]
State 264, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.01 -0.05]
State 265, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 266, Action E, Q-values: [+0.04 -0.02 +0.09 -0.02 +0.02 -0.04]
State 267, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.05]
State 268, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.04]
State 269, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.04]
State 270, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.05]
State 271, Action E, Q-values: [+0.05 -0.03 +0.09 -0.03 +0.02 -0.05]
State 272, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.05]
State 273, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 274, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.04]
State 275, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.01 -0.05]
State 276, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.01 -0.04]
State 277, Action E, Q-values: [+0.05 -0.02 +0.10 -0.02 +0.02 -0.05]
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State 278, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
State 279, Action E, Q-values: [+0.05 -0.04 +0.10 -0.01 +0.02 -0.04]
State 280, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.05]
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State 282, Action E, Q-values: [+0.05 -0.04 +0.09 -0.02 +0.02 -0.04]
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State 284, Action E, Q-values: [+0.04 -0.03 +0.10 -0.02 +0.02 -0.05]
State 285, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.01 -0.05]
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State 288, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.05]
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State 292, Action E, Q-values: [+0.05 -0.02 +0.10 -0.01 +0.02 -0.05]
State 293, Action E, Q-values: [+0.04 -0.02 +0.10 -0.02 +0.02 -0.05]
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State 298, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
State 299, Action E, Q-values: [+0.05 -0.02 +0.10 -0.02 +0.02 -0.04]
State 300, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.01 -0.04]
State 301, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.05]
State 302, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.05]
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State 304, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.01 -0.04]
State 305, Action E, Q-values: [+0.05 -0.03 +0.10 -0.01 +0.02 -0.05]
State 306, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
State 307, Action E, Q-values: [+0.05 -0.02 +0.09 -0.02 +0.02 -0.05]
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State 314, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 315, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.01 -0.05]
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State 323, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 324, Action E, Q-values: [+0.05 -0.02 +0.09 -0.02 +0.02 -0.04]
State 325, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.05]
State 326, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.05]
State 327, Action E, Q-values: [+0.06 -0.03 +0.09 -0.01 +0.01 -0.05]
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State 329, Action E, Q-values: [+0.04 -0.04 +0.09 -0.02 +0.02 -0.05]
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State 331, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.05]
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State 333, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 334, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.01 -0.05]
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State 342, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.05]
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State 353, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.05]
State 354, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.05]
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State 356, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.04]
State 357, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.05]
State 358, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
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State 390, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 391, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.04]
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State 395, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.05]
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State 399, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
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State 401, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.04]
State 402, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 403, Action E, Q-values: [+0.04 -0.03 +0.09 -0.03 +0.02 -0.04]
State 404, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.04]
State 405, Action E, Q-values: [+0.04 -0.03 +0.10 -0.02 +0.02 -0.04]
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State 431, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.01 -0.05]
State 432, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.04]
State 433, Action E, Q-values: [+0.04 -0.03 +0.10 -0.02 +0.02 -0.04]
State 434, Action E, Q-values: [+0.05 -0.03 +0.09 -0.03 +0.02 -0.05]
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State 438, Action E, Q-values: [+0.05 -0.02 +0.10 -0.01 +0.02 -0.05]
State 439, Action E, Q-values: [+0.05 -0.03 +0.10 -0.01 +0.02 -0.04]
State 440, Action E, Q-values: [+0.05 -0.04 +0.09 -0.02 +0.02 -0.05]
State 441, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.04]
State 442, Action E, Q-values: [+0.05 -0.02 +0.10 -0.01 +0.02 -0.04]
State 443, Action E, Q-values: [+0.05 -0.02 +0.10 -0.02 +0.01 -0.04]
State 444, Action E, Q-values: [+0.04 -0.03 +0.10 -0.02 +0.02 -0.05]
State 445, Action E, Q-values: [+0.05 -0.02 +0.10 -0.02 +0.02 -0.05]
State 446, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
State 447, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.01 -0.05]
State 448, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
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State 449, Action E, Q-values: [+0.05 -0.02 +0.09 -0.02 +0.01 -0.05]
State 450, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.05]
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State 454, Action E, Q-values: [+0.04 -0.02 +0.10 -0.02 +0.01 -0.05]
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State 461, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
State 462, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 463, Action E, Q-values: [+0.05 -0.02 +0.09 -0.02 +0.01 -0.05]
State 464, Action E, Q-values: [+0.05 -0.02 +0.10 -0.02 +0.01 -0.05]
State 465, Action E, Q-values: [+0.05 -0.03 +0.10 -0.01 +0.03 -0.04]
State 466, Action E, Q-values: [+0.04 -0.03 +0.10 -0.02 +0.01 -0.05]
State 467, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.01 -0.05]
State 468, Action E, Q-values: [+0.05 -0.02 +0.10 -0.02 +0.02 -0.05]
State 469, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.01 -0.05]
State 470, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 471, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.04]
State 472, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
State 473, Action E, Q-values: [+0.05 -0.02 +0.10 -0.02 +0.01 -0.05]
State 474, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.05]
State 475, Action E, Q-values: [+0.05 -0.02 +0.10 -0.02 +0.02 -0.04]
State 476, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
State 477, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.04]
State 478, Action E, Q-values: [+0.04 -0.03 +0.10 -0.02 +0.02 -0.05]
State 479, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 480, Action E, Q-values: [+0.06 -0.02 +0.10 -0.02 +0.01 -0.05]
State 481, Action E, Q-values: [+0.05 -0.03 +0.09 -0.03 +0.02 -0.05]
State 482, Action E, Q-values: [+0.04 -0.03 +0.10 -0.02 +0.02 -0.04]
State 483, Action E, Q-values: [+0.04 -0.02 +0.09 -0.02 +0.02 -0.04]
State 484, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.05]
State 485, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.05]
State 486, Action E, Q-values: [+0.04 -0.03 +0.10 -0.02 +0.02 -0.05]
State 487, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.05]
State 488, Action E, Q-values: [+0.05 -0.03 +0.09 -0.03 +0.02 -0.05]
State 489, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.05]
State 490, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
State 491, Action E, Q-values: [+0.05 -0.03 +0.08 -0.02 +0.01 -0.05]
State 492, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.01 -0.04]
State 493, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.05]
State 494, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.01 -0.05]
State 495, Action E, Q-values: [+0.04 -0.03 +0.09 -0.02 +0.02 -0.04]
State 496, Action E, Q-values: [+0.05 -0.03 +0.10 -0.02 +0.02 -0.04]
State 497, Action E, Q-values: [+0.05 -0.03 +0.09 -0.01 +0.02 -0.05]
State 498, Action E, Q-values: [+0.06 -0.03 +0.10 -0.02 +0.02 -0.04]
State 499, Action E, Q-values: [+0.05 -0.03 +0.09 -0.02 +0.02 -0.04]
Episode 100/100000, Avg Reward: -777.67, Epsilon: 0.99
Episode 200/100000, Avg Reward: -768.90, Epsilon: 0.99
Episode 300/100000, Avg Reward: -760.66, Epsilon: 0.98
Episode 400/100000, Avg Reward: -763.20, Epsilon: 0.97
Episode 500/100000, Avg Reward: -769.32, Epsilon: 0.97
Episode 600/100000, Avg Reward: -735.64, Epsilon: 0.96
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Episode 700/100000, Avg Reward: -757.37, Epsilon: 0.95
Episode 800/100000, Avg Reward: -745.28, Epsilon: 0.95
Episode 900/100000, Avg Reward: -726.35, Epsilon: 0.94
Episode 1000/100000, Avg Reward: -747.62, Epsilon: 0.93
Episode 1100/100000, Avg Reward: -742.45, Epsilon: 0.93
Episode 1200/100000, Avg Reward: -711.19, Epsilon: 0.92
Episode 1300/100000, Avg Reward: -729.76, Epsilon: 0.91
Episode 1400/100000, Avg Reward: -714.77, Epsilon: 0.91
Episode 1500/100000, Avg Reward: -718.28, Epsilon: 0.90
Episode 1600/100000, Avg Reward: -717.50, Epsilon: 0.90
Episode 1700/100000, Avg Reward: -720.74, Epsilon: 0.89
Episode 1800/100000, Avg Reward: -716.67, Epsilon: 0.88
Episode 1900/100000, Avg Reward: -692.38, Epsilon: 0.88
Episode 2000/100000, Avg Reward: -708.67, Epsilon: 0.87
Episode 2100/100000, Avg Reward: -705.78, Epsilon: 0.86
Episode 2200/100000, Avg Reward: -705.20, Epsilon: 0.86
Episode 2300/100000, Avg Reward: -680.24, Epsilon: 0.85
Episode 2400/100000, Avg Reward: -692.21, Epsilon: 0.85
Episode 2500/100000, Avg Reward: -697.11, Epsilon: 0.84
Episode 2600/100000, Avg Reward: -675.68, Epsilon: 0.84
Episode 2700/100000, Avg Reward: -679.63, Epsilon: 0.83
Episode 2800/100000, Avg Reward: -688.64, Epsilon: 0.82
Episode 2900/100000, Avg Reward: -662.65, Epsilon: 0.82
Episode 3000/100000, Avg Reward: -673.90, Epsilon: 0.81
Episode 3100/100000, Avg Reward: -672.91, Epsilon: 0.81
Episode 3200/100000, Avg Reward: -662.91, Epsilon: 0.80
Episode 3300/100000, Avg Reward: -642.21, Epsilon: 0.80
Episode 3400/100000, Avg Reward: -662.24, Epsilon: 0.79
Episode 3500/100000, Avg Reward: -653.20, Epsilon: 0.79
Episode 3600/100000, Avg Reward: -670.34, Epsilon: 0.78
Episode 3700/100000, Avg Reward: -642.58, Epsilon: 0.77
Episode 3800/100000, Avg Reward: -638.57, Epsilon: 0.77
Episode 3900/100000, Avg Reward: -644.15, Epsilon: 0.76
Episode 4000/100000, Avg Reward: -640.02, Epsilon: 0.76
Episode 4100/100000, Avg Reward: -617.98, Epsilon: 0.75
Episode 4200/100000, Avg Reward: -640.98, Epsilon: 0.75
Episode 4300/100000, Avg Reward: -625.04, Epsilon: 0.74
Episode 4400/100000, Avg Reward: -612.84, Epsilon: 0.74
Episode 4500/100000, Avg Reward: -629.11, Epsilon: 0.73
Episode 4600/100000, Avg Reward: -615.89, Epsilon: 0.73
Episode 4700/100000, Avg Reward: -621.47, Epsilon: 0.72
Episode 4800/100000, Avg Reward: -610.31, Epsilon: 0.72
Episode 4900/100000, Avg Reward: -621.29, Epsilon: 0.71
Episode 5000/100000, Avg Reward: -612.04, Epsilon: 0.71
Episode 5100/100000, Avg Reward: -591.88, Epsilon: 0.70
Episode 5200/100000, Avg Reward: -603.20, Epsilon: 0.70
Episode 5300/100000, Avg Reward: -601.64, Epsilon: 0.69
Episode 5400/100000, Avg Reward: -593.94, Epsilon: 0.69
Episode 5500/100000, Avg Reward: -600.92, Epsilon: 0.68
Episode 5600/100000, Avg Reward: -589.16, Epsilon: 0.68
Episode 5700/100000, Avg Reward: -599.41, Epsilon: 0.67
Episode 5800/100000, Avg Reward: -588.35, Epsilon: 0.67
Episode 5900/100000, Avg Reward: -577.65, Epsilon: 0.67
Episode 6000/100000, Avg Reward: -583.32, Epsilon: 0.66
Episode 6100/100000, Avg Reward: -570.32, Epsilon: 0.66
Episode 6200/100000, Avg Reward: -573.18, Epsilon: 0.65
Episode 6300/100000, Avg Reward: -577.10, Epsilon: 0.65
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Episode 6400/100000, Avg Reward: -581.12, Epsilon: 0.64
Episode 6500/100000, Avg Reward: -575.39, Epsilon: 0.64
Episode 6600/100000, Avg Reward: -572.42, Epsilon: 0.63
Episode 6700/100000, Avg Reward: -576.65, Epsilon: 0.63
Episode 6800/100000, Avg Reward: -552.75, Epsilon: 0.63
Episode 6900/100000, Avg Reward: -550.14, Epsilon: 0.62
Episode 7000/100000, Avg Reward: -547.09, Epsilon: 0.62
Episode 7100/100000, Avg Reward: -553.48, Epsilon: 0.61
Episode 7200/100000, Avg Reward: -549.62, Epsilon: 0.61
Episode 7300/100000, Avg Reward: -550.47, Epsilon: 0.60
Episode 7400/100000, Avg Reward: -540.62, Epsilon: 0.60
Episode 7500/100000, Avg Reward: -538.49, Epsilon: 0.60
Episode 7600/100000, Avg Reward: -526.47, Epsilon: 0.59
Episode 7700/100000, Avg Reward: -536.45, Epsilon: 0.59
Episode 7800/100000, Avg Reward: -545.06, Epsilon: 0.58
Episode 7900/100000, Avg Reward: -520.72, Epsilon: 0.58
Episode 8000/100000, Avg Reward: -527.18, Epsilon: 0.58
Episode 8100/100000, Avg Reward: -532.41, Epsilon: 0.57
Episode 8200/100000, Avg Reward: -532.50, Epsilon: 0.57
Episode 8300/100000, Avg Reward: -531.47, Epsilon: 0.56
Episode 8400/100000, Avg Reward: -517.35, Epsilon: 0.56
Episode 8500/100000, Avg Reward: -529.18, Epsilon: 0.56
Episode 8600/100000, Avg Reward: -515.25, Epsilon: 0.55
Episode 8700/100000, Avg Reward: -508.38, Epsilon: 0.55
Episode 8800/100000, Avg Reward: -508.50, Epsilon: 0.54
Episode 8900/100000, Avg Reward: -505.22, Epsilon: 0.54
Episode 9000/100000, Avg Reward: -508.52, Epsilon: 0.54
Episode 9100/100000, Avg Reward: -499.89, Epsilon: 0.53
Episode 9200/100000, Avg Reward: -510.67, Epsilon: 0.53
Episode 9300/100000, Avg Reward: -504.83, Epsilon: 0.53
Episode 9400/100000, Avg Reward: -505.80, Epsilon: 0.52
Episode 9500/100000, Avg Reward: -502.00, Epsilon: 0.52
Episode 9600/100000, Avg Reward: -499.01, Epsilon: 0.52
Episode 9700/100000, Avg Reward: -498.85, Epsilon: 0.51
Episode 9800/100000, Avg Reward: -493.22, Epsilon: 0.51
Episode 9900/100000, Avg Reward: -497.77, Epsilon: 0.50
Episode 10000/100000, Avg Reward: -489.51, Epsilon: 0.50
Episode 10100/100000, Avg Reward: -485.39, Epsilon: 0.50
Episode 10200/100000, Avg Reward: -487.37, Epsilon: 0.49
Episode 10300/100000, Avg Reward: -480.91, Epsilon: 0.49
Episode 10400/100000, Avg Reward: -479.81, Epsilon: 0.49
Episode 10500/100000, Avg Reward: -462.56, Epsilon: 0.48
Episode 10600/100000, Avg Reward: -476.58, Epsilon: 0.48
Episode 10700/100000, Avg Reward: -474.14, Epsilon: 0.48
Episode 10800/100000, Avg Reward: -488.00, Epsilon: 0.47
Episode 10900/100000, Avg Reward: -466.30, Epsilon: 0.47
Episode 11000/100000, Avg Reward: -476.52, Epsilon: 0.47
Episode 11100/100000, Avg Reward: -464.78, Epsilon: 0.46
Episode 11200/100000, Avg Reward: -458.55, Epsilon: 0.46
Episode 11300/100000, Avg Reward: -449.56, Epsilon: 0.46
Episode 11400/100000, Avg Reward: -457.75, Epsilon: 0.45
Episode 11500/100000, Avg Reward: -467.66, Epsilon: 0.45
Episode 11600/100000, Avg Reward: -460.55, Epsilon: 0.45
Episode 11700/100000, Avg Reward: -454.14, Epsilon: 0.45
Episode 11800/100000, Avg Reward: -450.20, Epsilon: 0.44
Episode 11900/100000, Avg Reward: -441.69, Epsilon: 0.44
Episode 12000/100000, Avg Reward: -451.46, Epsilon: 0.44
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Episode 12100/100000, Avg Reward: -447.98, Epsilon: 0.43
Episode 12200/100000, Avg Reward: -442.59, Epsilon: 0.43
Episode 12300/100000, Avg Reward: -446.15, Epsilon: 0.43
Episode 12400/100000, Avg Reward: -446.73, Epsilon: 0.42
Episode 12500/100000, Avg Reward: -443.81, Epsilon: 0.42
Episode 12600/100000, Avg Reward: -447.77, Epsilon: 0.42
Episode 12700/100000, Avg Reward: -433.49, Epsilon: 0.42
Episode 12800/100000, Avg Reward: -446.74, Epsilon: 0.41
Episode 12900/100000, Avg Reward: -432.51, Epsilon: 0.41
Episode 13000/100000, Avg Reward: -429.99, Epsilon: 0.41
Episode 13100/100000, Avg Reward: -434.90, Epsilon: 0.40
Episode 13200/100000, Avg Reward: -425.55, Epsilon: 0.40
Episode 13300/100000, Avg Reward: -434.00, Epsilon: 0.40
Episode 13400/100000, Avg Reward: -426.49, Epsilon: 0.40
Episode 13500/100000, Avg Reward: -426.73, Epsilon: 0.39
Episode 13600/100000, Avg Reward: -430.22, Epsilon: 0.39
Episode 13700/100000, Avg Reward: -433.64, Epsilon: 0.39
Episode 13800/100000, Avg Reward: -413.12, Epsilon: 0.39
Episode 13900/100000, Avg Reward: -419.06, Epsilon: 0.38
Episode 14000/100000, Avg Reward: -421.08, Epsilon: 0.38
Episode 14100/100000, Avg Reward: -414.01, Epsilon: 0.38
Episode 14200/100000, Avg Reward: -421.52, Epsilon: 0.37
Episode 14300/100000, Avg Reward: -420.37, Epsilon: 0.37
Episode 14400/100000, Avg Reward: -409.88, Epsilon: 0.37
Episode 14500/100000, Avg Reward: -417.17, Epsilon: 0.37
Episode 14600/100000, Avg Reward: -406.01, Epsilon: 0.36
Episode 14700/100000, Avg Reward: -407.95, Epsilon: 0.36
Episode 14800/100000, Avg Reward: -406.64, Epsilon: 0.36
Episode 14900/100000, Avg Reward: -408.89, Epsilon: 0.36
Episode 15000/100000, Avg Reward: -401.02, Epsilon: 0.35
Episode 15100/100000, Avg Reward: -403.97, Epsilon: 0.35
Episode 15200/100000, Avg Reward: -396.87, Epsilon: 0.35
Episode 15300/100000, Avg Reward: -398.45, Epsilon: 0.35
Episode 15400/100000, Avg Reward: -404.30, Epsilon: 0.35
Episode 15500/100000, Avg Reward: -390.17, Epsilon: 0.34
Episode 15600/100000, Avg Reward: -389.81, Epsilon: 0.34
Episode 15700/100000, Avg Reward: -400.07, Epsilon: 0.34
Episode 15800/100000, Avg Reward: -392.87, Epsilon: 0.34
Episode 15900/100000, Avg Reward: -389.36, Epsilon: 0.33
Episode 16000/100000, Avg Reward: -390.44, Epsilon: 0.33
Episode 16100/100000, Avg Reward: -393.86, Epsilon: 0.33
Episode 16200/100000, Avg Reward: -381.84, Epsilon: 0.33
Episode 16300/100000, Avg Reward: -391.34, Epsilon: 0.32
Episode 16400/100000, Avg Reward: -389.27, Epsilon: 0.32
Episode 16500/100000, Avg Reward: -387.20, Epsilon: 0.32
Episode 16600/100000, Avg Reward: -375.88, Epsilon: 0.32
Episode 16700/100000, Avg Reward: -377.06, Epsilon: 0.32
Episode 16800/100000, Avg Reward: -377.66, Epsilon: 0.31
Episode 16900/100000, Avg Reward: -380.81, Epsilon: 0.31
Episode 17000/100000, Avg Reward: -385.13, Epsilon: 0.31
Episode 17100/100000, Avg Reward: -375.23, Epsilon: 0.31
Episode 17200/100000, Avg Reward: -371.81, Epsilon: 0.30
Episode 17300/100000, Avg Reward: -376.04, Epsilon: 0.30
Episode 17400/100000, Avg Reward: -368.37, Epsilon: 0.30
Episode 17500/100000, Avg Reward: -376.40, Epsilon: 0.30
Episode 17600/100000, Avg Reward: -372.08, Epsilon: 0.30
Episode 17700/100000, Avg Reward: -364.99, Epsilon: 0.29
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Episode 17800/100000, Avg Reward: -368.93, Epsilon: 0.29
Episode 17900/100000, Avg Reward: -368.88, Epsilon: 0.29
Episode 18000/100000, Avg Reward: -365.60, Epsilon: 0.29
Episode 18100/100000, Avg Reward: -364.79, Epsilon: 0.29
Episode 18200/100000, Avg Reward: -364.70, Epsilon: 0.28
Episode 18300/100000, Avg Reward: -361.82, Epsilon: 0.28
Episode 18400/100000, Avg Reward: -360.83, Epsilon: 0.28
Episode 18500/100000, Avg Reward: -359.03, Epsilon: 0.28
Episode 18600/100000, Avg Reward: -359.30, Epsilon: 0.28
Episode 18700/100000, Avg Reward: -366.95, Epsilon: 0.27
Episode 18800/100000, Avg Reward: -358.58, Epsilon: 0.27
Episode 18900/100000, Avg Reward: -360.11, Epsilon: 0.27
Episode 19000/100000, Avg Reward: -350.93, Epsilon: 0.27
Episode 19100/100000, Avg Reward: -357.05, Epsilon: 0.27
Episode 19200/100000, Avg Reward: -349.76, Epsilon: 0.27
Episode 19300/100000, Avg Reward: -351.29, Epsilon: 0.26
Episode 19400/100000, Avg Reward: -352.37, Epsilon: 0.26
Episode 19500/100000, Avg Reward: -343.28, Epsilon: 0.26
Episode 19600/100000, Avg Reward: -349.49, Epsilon: 0.26
Episode 19700/100000, Avg Reward: -343.16, Epsilon: 0.26
Episode 19800/100000, Avg Reward: -344.99, Epsilon: 0.25
Episode 19900/100000, Avg Reward: -350.57, Epsilon: 0.25
Episode 20000/100000, Avg Reward: -339.95, Epsilon: 0.25
Episode 20100/100000, Avg Reward: -344.63, Epsilon: 0.25
Episode 20200/100000, Avg Reward: -340.49, Epsilon: 0.25
Episode 20300/100000, Avg Reward: -344.18, Epsilon: 0.25
Episode 20400/100000, Avg Reward: -341.30, Epsilon: 0.24
Episode 20500/100000, Avg Reward: -340.58, Epsilon: 0.24
Episode 20600/100000, Avg Reward: -339.05, Epsilon: 0.24
Episode 20700/100000, Avg Reward: -336.17, Epsilon: 0.24
Episode 20800/100000, Avg Reward: -326.97, Epsilon: 0.24
Episode 20900/100000, Avg Reward: -333.74, Epsilon: 0.24
Episode 21000/100000, Avg Reward: -329.69, Epsilon: 0.23
Episode 21100/100000, Avg Reward: -335.90, Epsilon: 0.23
Episode 21200/100000, Avg Reward: -330.50, Epsilon: 0.23
Episode 21300/100000, Avg Reward: -333.65, Epsilon: 0.23
Episode 21400/100000, Avg Reward: -337.52, Epsilon: 0.23
Episode 21500/100000, Avg Reward: -332.03, Epsilon: 0.23
Episode 21600/100000, Avg Reward: -332.93, Epsilon: 0.22
Episode 21700/100000, Avg Reward: -334.19, Epsilon: 0.22
Episode 21800/100000, Avg Reward: -325.64, Epsilon: 0.22
Episode 21900/100000, Avg Reward: -325.19, Epsilon: 0.22
Episode 22000/100000, Avg Reward: -323.48, Epsilon: 0.22
Episode 22100/100000, Avg Reward: -326.63, Epsilon: 0.22
Episode 22200/100000, Avg Reward: -325.73, Epsilon: 0.22
Episode 22300/100000, Avg Reward: -328.79, Epsilon: 0.21
Episode 22400/100000, Avg Reward: -330.86, Epsilon: 0.21
Episode 22500/100000, Avg Reward: -320.87, Epsilon: 0.21
Episode 22600/100000, Avg Reward: -322.67, Epsilon: 0.21
Episode 22700/100000, Avg Reward: -319.79, Epsilon: 0.21
Episode 22800/100000, Avg Reward: -318.27, Epsilon: 0.21
Episode 22900/100000, Avg Reward: -317.27, Epsilon: 0.21
Episode 23000/100000, Avg Reward: -318.44, Epsilon: 0.20
Episode 23100/100000, Avg Reward: -316.21, Epsilon: 0.20
Episode 23200/100000, Avg Reward: -311.24, Epsilon: 0.20
Episode 23300/100000, Avg Reward: -313.52, Epsilon: 0.20
Episode 23400/100000, Avg Reward: -312.14, Epsilon: 0.20
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Episode 23500/100000, Avg Reward: -314.30, Epsilon: 0.20
Episode 23600/100000, Avg Reward: -309.62, Epsilon: 0.20
Episode 23700/100000, Avg Reward: -316.28, Epsilon: 0.19
Episode 23800/100000, Avg Reward: -313.94, Epsilon: 0.19
Episode 23900/100000, Avg Reward: -308.09, Epsilon: 0.19
Episode 24000/100000, Avg Reward: -311.24, Epsilon: 0.19
Episode 24100/100000, Avg Reward: -310.52, Epsilon: 0.19
Episode 24200/100000, Avg Reward: -305.30, Epsilon: 0.19
Episode 24300/100000, Avg Reward: -307.10, Epsilon: 0.19
Episode 24400/100000, Avg Reward: -304.04, Epsilon: 0.19
Episode 24500/100000, Avg Reward: -302.69, Epsilon: 0.18
Episode 24600/100000, Avg Reward: -309.98, Epsilon: 0.18
Episode 24700/100000, Avg Reward: -301.52, Epsilon: 0.18
Episode 24800/100000, Avg Reward: -300.62, Epsilon: 0.18
Episode 24900/100000, Avg Reward: -306.65, Epsilon: 0.18
Episode 25000/100000, Avg Reward: -304.49, Epsilon: 0.18
Episode 25100/100000, Avg Reward: -302.87, Epsilon: 0.18
Episode 25200/100000, Avg Reward: -304.85, Epsilon: 0.18
Episode 25300/100000, Avg Reward: -292.61, Epsilon: 0.17
Episode 25400/100000, Avg Reward: -298.73, Epsilon: 0.17
Episode 25500/100000, Avg Reward: -297.38, Epsilon: 0.17
Episode 25600/100000, Avg Reward: -296.75, Epsilon: 0.17
Episode 25700/100000, Avg Reward: -294.32, Epsilon: 0.17
Episode 25800/100000, Avg Reward: -300.80, Epsilon: 0.17
Episode 25900/100000, Avg Reward: -296.21, Epsilon: 0.17
Episode 26000/100000, Avg Reward: -295.58, Epsilon: 0.17
Episode 26100/100000, Avg Reward: -296.66, Epsilon: 0.16
Episode 26200/100000, Avg Reward: -296.48, Epsilon: 0.16
Episode 26300/100000, Avg Reward: -296.03, Epsilon: 0.16
Episode 26400/100000, Avg Reward: -289.28, Epsilon: 0.16
Episode 26500/100000, Avg Reward: -293.96, Epsilon: 0.16
Episode 26600/100000, Avg Reward: -295.58, Epsilon: 0.16
Episode 26700/100000, Avg Reward: -291.98, Epsilon: 0.16
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Episode 26900/100000, Avg Reward: -288.65, Epsilon: 0.16
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Episode 27100/100000, Avg Reward: -289.55, Epsilon: 0.15
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Episode 34500/100000, Avg Reward: -253.82, Epsilon: 0.09
Episode 34600/100000, Avg Reward: -253.28, Epsilon: 0.09
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Episode 34800/100000, Avg Reward: -250.04, Epsilon: 0.09
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Episode 90600/100000, Avg Reward: -200.99, Epsilon: 0.00
Episode 90700/100000, Avg Reward: -200.45, Epsilon: 0.00
Episode 90800/100000, Avg Reward: -200.99, Epsilon: 0.00
Episode 90900/100000, Avg Reward: -200.99, Epsilon: 0.00
Episode 91000/100000, Avg Reward: -200.81, Epsilon: 0.00
Episode 91100/100000, Avg Reward: -201.17, Epsilon: 0.00
Episode 91200/100000, Avg Reward: -200.45, Epsilon: 0.00
Episode 91300/100000, Avg Reward: -201.26, Epsilon: 0.00
Episode 91400/100000, Avg Reward: -200.81, Epsilon: 0.00
Episode 91500/100000, Avg Reward: -200.63, Epsilon: 0.00
Episode 91600/100000, Avg Reward: -200.90, Epsilon: 0.00
Episode 91700/100000, Avg Reward: -200.63, Epsilon: 0.00
Episode 91800/100000, Avg Reward: -201.17, Epsilon: 0.00
```

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Episode 91900/100000, Avg Reward: -201.71, Epsilon: 0.00
Episode 92000/100000, Avg Reward: -201.08, Epsilon: 0.00
Episode 92100/100000, Avg Reward: -201.35, Epsilon: 0.00
Episode 92200/100000, Avg Reward: -201.17, Epsilon: 0.00
Episode 92300/100000, Avg Reward: -200.72, Epsilon: 0.00
Episode 92400/100000, Avg Reward: -200.99, Epsilon: 0.00
Episode 92500/100000, Avg Reward: -200.72, Epsilon: 0.00
Episode 92600/100000, Avg Reward: -201.08, Epsilon: 0.00
Episode 92700/100000, Avg Reward: -200.81, Epsilon: 0.00
Episode 92800/100000, Avg Reward: -201.53, Epsilon: 0.00
Episode 92900/100000, Avg Reward: -201.26, Epsilon: 0.00
Episode 93000/100000, Avg Reward: -200.63, Epsilon: 0.00
Episode 93100/100000, Avg Reward: -200.27, Epsilon: 0.00
Episode 93200/100000, Avg Reward: -201.53, Epsilon: 0.00
Episode 93300/100000, Avg Reward: -201.35, Epsilon: 0.00
Episode 93400/100000, Avg Reward: -200.54, Epsilon: 0.00
Episode 93500/100000, Avg Reward: -201.62, Epsilon: 0.00
Episode 93600/100000, Avg Reward: -200.63, Epsilon: 0.00
Episode 93700/100000, Avg Reward: -200.99, Epsilon: 0.00
Episode 93800/100000, Avg Reward: -201.08, Epsilon: 0.00
Episode 93900/100000, Avg Reward: -201.08, Epsilon: 0.00
Episode 94000/100000, Avg Reward: -218.63, Epsilon: 0.00
Episode 94100/100000, Avg Reward: -218.99, Epsilon: 0.00
Episode 94200/100000, Avg Reward: -200.90, Epsilon: 0.00
Episode 94300/100000, Avg Reward: -200.81, Epsilon: 0.00
Episode 94400/100000, Avg Reward: -200.72, Epsilon: 0.00
Episode 94500/100000, Avg Reward: -200.54, Epsilon: 0.00
Episode 94600/100000, Avg Reward: -200.99, Epsilon: 0.00
Episode 94700/100000, Avg Reward: -200.63, Epsilon: 0.00
Episode 94800/100000, Avg Reward: -200.81, Epsilon: 0.00
Episode 94900/100000, Avg Reward: -200.90, Epsilon: 0.00
Episode 95000/100000, Avg Reward: -201.26, Epsilon: 0.00
Episode 95100/100000, Avg Reward: -201.71, Epsilon: 0.00
Episode 95200/100000, Avg Reward: -200.81, Epsilon: 0.00
Episode 95300/100000, Avg Reward: -201.08, Epsilon: 0.00
Episode 95400/100000, Avg Reward: -200.63, Epsilon: 0.00
Episode 95500/100000, Avg Reward: -200.45, Epsilon: 0.00
Episode 95600/100000, Avg Reward: -200.54, Epsilon: 0.00
Episode 95700/100000, Avg Reward: -200.54, Epsilon: 0.00
Episode 95800/100000, Avg Reward: -201.08, Epsilon: 0.00
Episode 95900/100000, Avg Reward: -200.63, Epsilon: 0.00
Episode 96000/100000, Avg Reward: -218.72, Epsilon: 0.00
Episode 96100/100000, Avg Reward: -201.08, Epsilon: 0.00
Episode 96200/100000, Avg Reward: -200.72, Epsilon: 0.00
Episode 96300/100000, Avg Reward: -200.72, Epsilon: 0.00
Episode 96400/100000, Avg Reward: -200.72, Epsilon: 0.00
Episode 96500/100000, Avg Reward: -200.72, Epsilon: 0.00
Episode 96600/100000, Avg Reward: -200.90, Epsilon: 0.00
Episode 96700/100000, Avg Reward: -201.44, Epsilon: 0.00
Episode 96800/100000, Avg Reward: -200.72, Epsilon: 0.00
Episode 96900/100000, Avg Reward: -200.63, Epsilon: 0.00
Episode 97000/100000, Avg Reward: -201.17, Epsilon: 0.00
Episode 97100/100000, Avg Reward: -200.63, Epsilon: 0.00
Episode 97200/100000, Avg Reward: -200.90, Epsilon: 0.00
Episode 97300/100000, Avg Reward: -200.72, Epsilon: 0.00
Episode 97400/100000, Avg Reward: -200.54, Epsilon: 0.00
Episode 97500/100000, Avg Reward: -200.72, Epsilon: 0.00
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Episode 97600/100000, Avg Reward: -200.63, Epsilon: 0.00
Episode 97700/100000, Avg Reward: -200.90, Epsilon: 0.00
Episode 97800/100000, Avg Reward: -200.54, Epsilon: 0.00
Episode 97900/100000, Avg Reward: -200.72, Epsilon: 0.00
Episode 98000/100000, Avg Reward: -200.72, Epsilon: 0.00
Episode 98100/100000, Avg Reward: -200.63, Epsilon: 0.00
Episode 98200/100000, Avg Reward: -200.81, Epsilon: 0.00
Episode 98300/100000, Avg Reward: -200.45, Epsilon: 0.00
Episode 98400/100000, Avg Reward: -200.54, Epsilon: 0.00
Episode 98500/100000, Avg Reward: -200.63, Epsilon: 0.00
Episode 98600/100000, Avg Reward: -200.09, Epsilon: 0.00
Episode 98700/100000, Avg Reward: -200.36, Epsilon: 0.00
Episode 98800/100000, Avg Reward: -201.08, Epsilon: 0.00
Episode 98900/100000, Avg Reward: -200.27, Epsilon: 0.00
Episode 99000/100000, Avg Reward: -200.36, Epsilon: 0.00
Episode 99100/100000, Avg Reward: -200.27, Epsilon: 0.00
Episode 99200/100000, Avg Reward: -200.36, Epsilon: 0.00
Episode 99300/100000, Avg Reward: -218.54, Epsilon: 0.00
Episode 99400/100000, Avg Reward: -200.81, Epsilon: 0.00
Episode 99500/100000, Avg Reward: -200.36, Epsilon: 0.00
Episode 99600/100000, Avg Reward: -200.90, Epsilon: 0.00
Episode 99700/100000, Avg Reward: -200.63, Epsilon: 0.00
Episode 99800/100000, Avg Reward: -200.27, Epsilon: 0.00
Episode 99900/100000, Avg Reward: -200.54, Epsilon: 0.00
Episode 100000/100000, Avg Reward: -200.54, Epsilon: 0.00
!!!!!!!!!!!!!!!!Trained and Stored the model successfully!!!!!!!!!!!!!!!!!
CPU times: user 2h 43min 24s, sys: 11min 42s, total: 2h 55min 6s
Wall time: 59min 45s
```
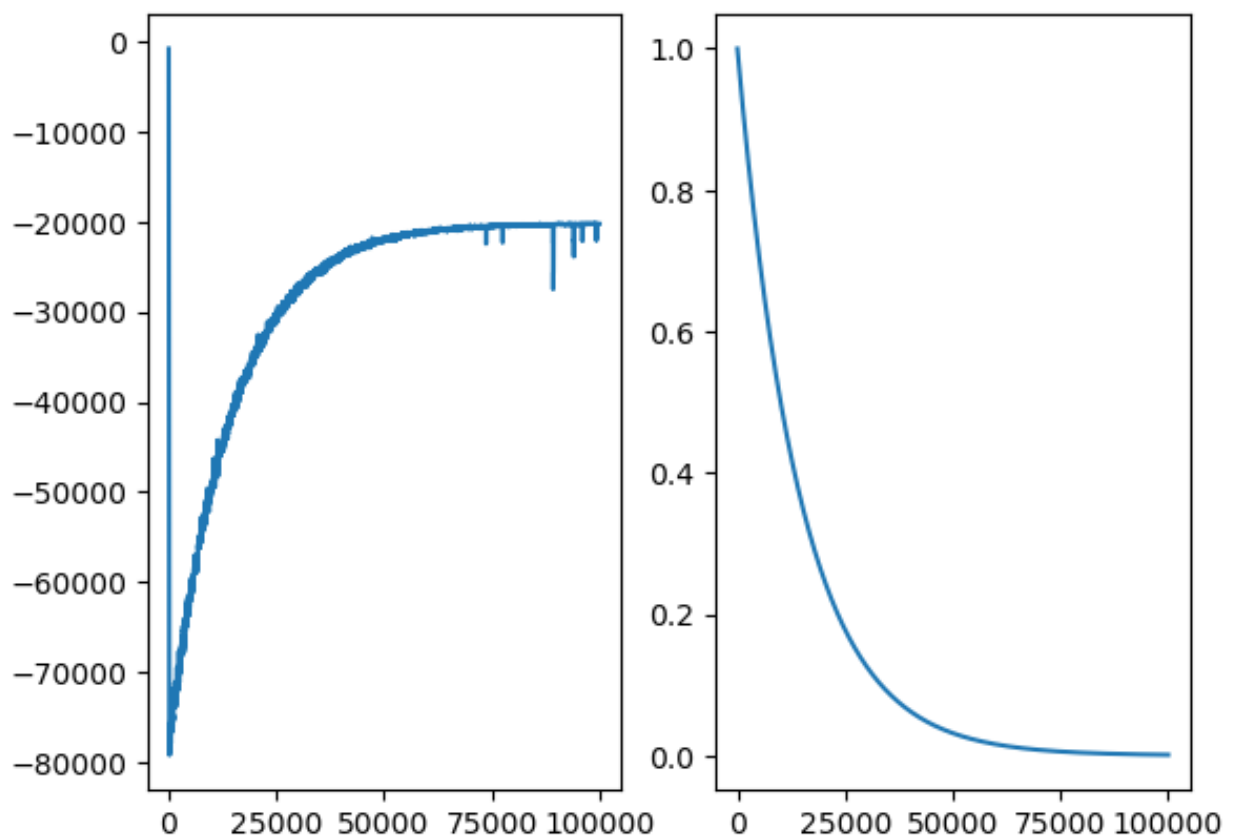


```
In [100…  print(my_dqn_agent_controlled_training_rewards )

          [-830. -785. -794. ... -200. -200. -200.]
```

```
controlled_training = {
  "my_q_agent_controlled_training_rewards": list(my_q_agent_controlled_tr
  "my_dqn_agent_controlled_training_rewards": list(my_dqn_agent_controlle
}
```

```
print(type(my_q_agent_controlled_training_rewards))
print(type(my_dqn_agent_controlled_training_rewards))
```

```
<class 'numpy.ndarray'>
<class 'numpy.ndarray'>
```

```
with open("controlled_training.json", "w") as f:
    json.dump(controlled_training, f)

# r = {'is_claimed': 'True', 'rating': 3.5}
# r = json.dumps(controlled_training)
# loaded_r = json.loads(r)
```

```
with open("controlled_training.json", "r") as f:
    controlled_training_dict = json.load(f)

# controlled_training_dict = json.loads(jsonString)
```

Compare the training reward

```
x = range(1,100000 + 1)

plt.figure(figsize=(10, 6))
plt.plot(x, controlled_training_dict["my_dqn_agent_controlled_training_re
plt.plot(x, controlled_training_dict["my_q_agent_controlled_training_rewa

# titles and labels
plt.title('Training Comparison (Controlled Parameters)')
plt.xlabel('Time Episodes')
plt.ylabel('Average Reward')
plt.legend()
# display
plt.grid(True)
plt.show()
```

Training Comparison (Controlled Parameters)
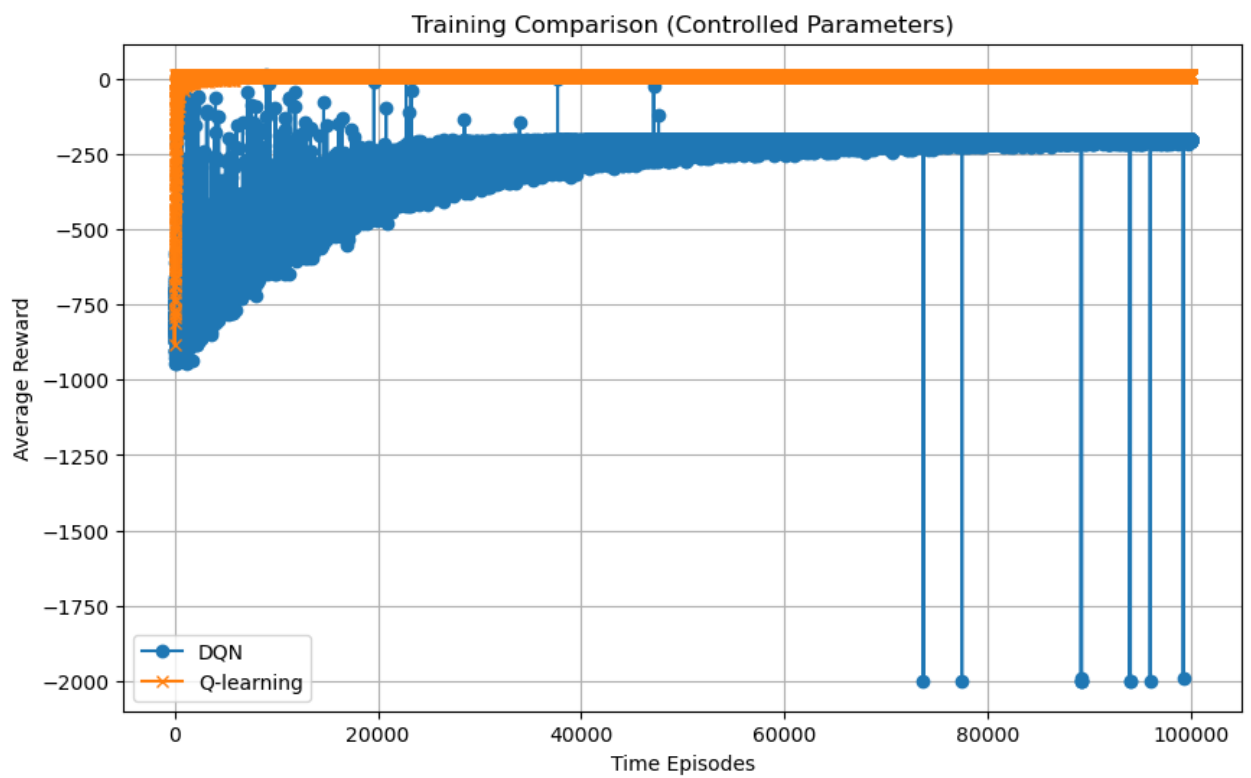
Prediction with the Controlled models

Q Learning Agent with Controlled Parameters

```
In [65]: my_q_agent_controlled_avg_reward_lst = my_q_agent_controlled.test(test_ep
```

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EPISODE  0
Score of total rewards: 9
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EPISODE  1
Score of total rewards: 14
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EPISODE  2
Score of total rewards: 7
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EPISODE  3
Score of total rewards: 8
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EPISODE  4
Score of total rewards: 5
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EPISODE  5
Score of total rewards: 13
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EPISODE  6
Score of total rewards: 8
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EPISODE  7
Score of total rewards: 11
====================================================
EPISODE  8
Score of total rewards: 8
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```

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EPISODE  9
Score of total rewards: 10
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EPISODE  10
Score of total rewards: 7
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EPISODE  11
Score of total rewards: 6
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EPISODE  12
Score of total rewards: 8
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EPISODE  13
Score of total rewards: 4
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EPISODE  14
Score of total rewards: 6
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EPISODE  15
Score of total rewards: 4
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EPISODE  16
Score of total rewards: 7
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EPISODE  17
Score of total rewards: 6
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EPISODE  18
Score of total rewards: 6
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EPISODE  19
Score of total rewards: 12
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EPISODE  20
Score of total rewards: 9
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EPISODE  21
Score of total rewards: 8
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EPISODE  22
Score of total rewards: 5
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EPISODE  23
Score of total rewards: 9
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EPISODE  24
Score of total rewards: 4
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EPISODE  25
Score of total rewards: 11
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EPISODE  26
Score of total rewards: 7
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EPISODE  27
Score of total rewards: 9
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EPISODE  28
Score of total rewards: 11
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EPISODE  29
Score of total rewards: 4
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EPISODE  30
Score of total rewards: 11
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EPISODE  31
Score of total rewards: 3
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EPISODE  32
Score of total rewards: 6
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EPISODE  33
Score of total rewards: 9
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EPISODE  34
Score of total rewards: 7
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EPISODE  35
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EPISODE  38
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EPISODE  41
Score of total rewards: 13
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EPISODE  42
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EPISODE  43
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EPISODE  44
Score of total rewards: 9
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EPISODE  45
Score of total rewards: 11
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EPISODE  46
Score of total rewards: 6
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EPISODE  47
Score of total rewards: 5
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EPISODE  48
Score of total rewards: 9
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EPISODE  49
Score of total rewards: 6
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EPISODE  50
Score of total rewards: 10
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EPISODE  51
Score of total rewards: 5
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EPISODE  52
Score of total rewards: 11
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EPISODE  53
Score of total rewards: 6
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EPISODE  54
Score of total rewards: 8
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EPISODE  55
Score of total rewards: 12
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EPISODE  56
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EPISODE  57
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EPISODE  58
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EPISODE  59
Score of total rewards: 3
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EPISODE  60
Score of total rewards: 6
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EPISODE  61
Score of total rewards: 10
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EPISODE  62
Score of total rewards: 5
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EPISODE  63
Score of total rewards: 7
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EPISODE  64
Score of total rewards: 9
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EPISODE  65
Score of total rewards: 5
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EPISODE  66
Score of total rewards: 10
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EPISODE  67
Score of total rewards: 8
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EPISODE  68
Score of total rewards: 8
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EPISODE  69
Score of total rewards: 10
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EPISODE  70
Score of total rewards: 9
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EPISODE  71
Score of total rewards: 5
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EPISODE  72
Score of total rewards: 7
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EPISODE  73
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EPISODE  74
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EPISODE  75
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EPISODE  79
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EPISODE  80
Score of total rewards: 10
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EPISODE  81
Score of total rewards: 5
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EPISODE  82
Score of total rewards: 9
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EPISODE  83
Score of total rewards: 14
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EPISODE  84
Score of total rewards: 7
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EPISODE  85
Score of total rewards: 12
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EPISODE  86
Score of total rewards: 5
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EPISODE  87
Score of total rewards: 5
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EPISODE  88
Score of total rewards: 9
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EPISODE  89
Score of total rewards: 5
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EPISODE  90
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EPISODE  91
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EPISODE  99
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EPISODE  101
Score of total rewards: 10
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EPISODE  102
Score of total rewards: 4
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EPISODE  103
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EPISODE  104
Score of total rewards: 7
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EPISODE  105
Score of total rewards: 9
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EPISODE  106
Score of total rewards: 6
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EPISODE  107
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EPISODE  108
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EPISODE  109
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EPISODE  110
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EPISODE  123
Score of total rewards: 10
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EPISODE  124
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EPISODE  126
Score of total rewards: 11
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EPISODE  127
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EPISODE  128
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EPISODE  139
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EPISODE  142
Score of total rewards: 10
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EPISODE  143
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EPISODE  160
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EPISODE  161
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EPISODE  164
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EPISODE  165
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EPISODE  180
Score of total rewards: 8
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EPISODE  181
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EPISODE  182
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EPISODE  197
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EPISODE  199
Score of total rewards: 12
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EPISODE  200
Score of total rewards: 6
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EPISODE  201
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EPISODE  202
Score of total rewards: 6
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EPISODE  203
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EPISODE  204
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EPISODE  205
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EPISODE  218
Score of total rewards: 8
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EPISODE  219
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Score of total rewards: 11
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EPISODE  237
Score of total rewards: 9
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EPISODE  238
Score of total rewards: 8
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EPISODE  239
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EPISODE  240
Score of total rewards: 14
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EPISODE  241
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Score of total rewards: 6
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EPISODE  252
Score of total rewards: 5
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EPISODE  253
Score of total rewards: 3
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EPISODE  254
Score of total rewards: 10
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EPISODE  255
Score of total rewards: 6
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EPISODE  256
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EPISODE  679
Score of total rewards: 12
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EPISODE  680
Score of total rewards: 9
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EPISODE  681
Score of total rewards: 3
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EPISODE  682
Score of total rewards: 7
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EPISODE  683
Score of total rewards: 9
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EPISODE  684
Score of total rewards: 6
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EPISODE  685
Score of total rewards: 13
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EPISODE  686
Score of total rewards: 5
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EPISODE  687
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EPISODE  688
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EPISODE  689
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EPISODE  691
Score of total rewards: 7
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EPISODE  692
Score of total rewards: 5
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EPISODE  693
Score of total rewards: 5
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EPISODE  694
Score of total rewards: 10
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EPISODE  695
Score of total rewards: 2
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EPISODE  696
Score of total rewards: 6
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EPISODE  697
Score of total rewards: 8
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EPISODE  698
Score of total rewards: 10
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EPISODE  700
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EPISODE  701
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EPISODE  709
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EPISODE  710
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EPISODE  711
Score of total rewards: 10
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EPISODE  712
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EPISODE  713
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EPISODE  714
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EPISODE  715
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EPISODE  716
Score of total rewards: 11
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EPISODE  718
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EPISODE  719
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EPISODE  720
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EPISODE  721
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EPISODE  722
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EPISODE  724
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EPISODE  725
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EPISODE  726
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EPISODE  727
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EPISODE  728
Score of total rewards: 14
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EPISODE  729
Score of total rewards: 5
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EPISODE  730
Score of total rewards: 7
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EPISODE  731
Score of total rewards: 11
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EPISODE  732
Score of total rewards: 10
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EPISODE  733
Score of total rewards: 4
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EPISODE  734
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EPISODE  735
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EPISODE  736
Score of total rewards: 3
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EPISODE  737
Score of total rewards: 11
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EPISODE  738
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EPISODE  739
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EPISODE  740
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EPISODE  741
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EPISODE  742
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EPISODE  744
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EPISODE  745
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EPISODE  746
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EPISODE  747
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EPISODE  748
Score of total rewards: 8
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EPISODE  749
Score of total rewards: 5
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EPISODE  750
Score of total rewards: 7
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EPISODE  751
Score of total rewards: 4
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EPISODE  752
Score of total rewards: 7
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EPISODE  753
Score of total rewards: 5
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EPISODE  754
Score of total rewards: 10
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EPISODE  755
Score of total rewards: 6
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EPISODE  756
Score of total rewards: 9
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EPISODE  757
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EPISODE  758
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EPISODE  762
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EPISODE  763
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EPISODE  764
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EPISODE  765
Score of total rewards: 7
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EPISODE  766
Score of total rewards: 7
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EPISODE  767
Score of total rewards: 5
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EPISODE  768
Score of total rewards: 8
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EPISODE  769
Score of total rewards: 9
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EPISODE  770
Score of total rewards: 12
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EPISODE  771
Score of total rewards: 3
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EPISODE  772
Score of total rewards: 10
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EPISODE  773
Score of total rewards: 11
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EPISODE  774
Score of total rewards: 5
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EPISODE  775
Score of total rewards: 6
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EPISODE  776
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EPISODE  777
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EPISODE  778
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EPISODE  779
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EPISODE  780
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EPISODE  781
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EPISODE  782
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EPISODE  783
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EPISODE  784
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EPISODE  785
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EPISODE  786
Score of total rewards: 9
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EPISODE  787
Score of total rewards: 11
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EPISODE  788
Score of total rewards: 8
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EPISODE  789
Score of total rewards: 11
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EPISODE  790
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EPISODE  791
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EPISODE  792
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EPISODE  793
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EPISODE  800
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EPISODE  807
Score of total rewards: 9
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EPISODE  808
Score of total rewards: 4
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EPISODE  809
Score of total rewards: 3
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EPISODE  810
Score of total rewards: 7
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EPISODE  811
Score of total rewards: 8
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EPISODE  812
Score of total rewards: 9
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EPISODE  813
Score of total rewards: 10
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EPISODE  814
Score of total rewards: 10
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EPISODE  815
Score of total rewards: 13
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EPISODE  816
Score of total rewards: 9
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EPISODE  817
Score of total rewards: 11
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EPISODE  818
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EPISODE  819
Score of total rewards: 6
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EPISODE  820
Score of total rewards: 11
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EPISODE  821
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EPISODE  822
Score of total rewards: 9
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EPISODE  823
Score of total rewards: 6
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EPISODE  824
Score of total rewards: 5
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EPISODE  825
Score of total rewards: 5
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EPISODE  826
Score of total rewards: 10
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EPISODE  827
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EPISODE  828
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EPISODE  829
Score of total rewards: 6
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EPISODE  830
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EPISODE  831
Score of total rewards: 7
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EPISODE  832
Score of total rewards: 9
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EPISODE  833
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EPISODE  835
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EPISODE  838
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EPISODE  840
Score of total rewards: 14
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EPISODE  841
Score of total rewards: 8
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EPISODE  842
Score of total rewards: 11
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EPISODE  843
Score of total rewards: 8
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EPISODE  844
Score of total rewards: 11
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EPISODE  845
Score of total rewards: 6
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EPISODE  846
Score of total rewards: 8
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EPISODE  847
Score of total rewards: 4
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EPISODE  848
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EPISODE  849
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EPISODE  850
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EPISODE  851
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EPISODE  861
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EPISODE  862
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EPISODE  863
Score of total rewards: 9
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EPISODE  864
Score of total rewards: 11
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EPISODE  865
Score of total rewards: 9
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EPISODE  866
Score of total rewards: 8
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EPISODE  867
Score of total rewards: 9
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EPISODE  868
Score of total rewards: 6
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EPISODE  869
Score of total rewards: 10
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EPISODE  870
Score of total rewards: 11
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EPISODE  871
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EPISODE  872
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EPISODE  880
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EPISODE  881
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EPISODE  882
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EPISODE  883
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EPISODE  884
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EPISODE  885
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EPISODE  890
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EPISODE  891
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EPISODE  892
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EPISODE  894
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EPISODE  895
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EPISODE  896
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EPISODE  897
Score of total rewards: 11
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EPISODE  898
Score of total rewards: 8
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EPISODE  899
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EPISODE  900
Score of total rewards: 8
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EPISODE  901
Score of total rewards: 5
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EPISODE  902
Score of total rewards: 8
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EPISODE  903
Score of total rewards: 3
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EPISODE  904
Score of total rewards: 5
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EPISODE  905
Score of total rewards: 7
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EPISODE  906
Score of total rewards: 7
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EPISODE  907
Score of total rewards: 2
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EPISODE  908
Score of total rewards: 10
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EPISODE  909
Score of total rewards: 12
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EPISODE  910
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EPISODE  911
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EPISODE  914
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EPISODE  915
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EPISODE  919
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EPISODE  920
Score of total rewards: 4
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EPISODE  921
Score of total rewards: 7
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EPISODE  922
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EPISODE  923
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EPISODE  924
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EPISODE  925
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EPISODE  937
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EPISODE  939
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EPISODE  940
Score of total rewards: 3
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EPISODE  941
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EPISODE  942
Score of total rewards: 4
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EPISODE  943
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EPISODE  946
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EPISODE  947
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EPISODE  949
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EPISODE  950
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EPISODE  951
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EPISODE  952
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EPISODE  953
Score of total rewards: 6
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EPISODE  954
Score of total rewards: 6
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EPISODE  955
Score of total rewards: 11
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EPISODE  956
Score of total rewards: 4
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EPISODE  957
Score of total rewards: 10
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EPISODE  958
Score of total rewards: 12
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```

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EPISODE  959
Score of total rewards: 12
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EPISODE  960
Score of total rewards: 9
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EPISODE  961
Score of total rewards: 14
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EPISODE  962
Score of total rewards: 9
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EPISODE  963
Score of total rewards: 8
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EPISODE  964
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EPISODE  965
Score of total rewards: 11
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EPISODE  966
Score of total rewards: 5
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EPISODE  967
Score of total rewards: 9
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EPISODE  968
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EPISODE  969
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EPISODE  970
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EPISODE  971
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EPISODE  976
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EPISODE  977
Score of total rewards: 11
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EPISODE  978
Score of total rewards: 4
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EPISODE  979
Score of total rewards: 10
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EPISODE  980
Score of total rewards: 5
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EPISODE  981
Score of total rewards: 6
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EPISODE  982
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EPISODE  983
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EPISODE  989
Score of total rewards: 5
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EPISODE  990
Score of total rewards: 4
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EPISODE  991
Score of total rewards: 6
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EPISODE  992
Score of total rewards: 7
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EPISODE  993
Score of total rewards: 5
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EPISODE  994
Score of total rewards: 9
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EPISODE  995
Score of total rewards: 4
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EPISODE  996
Score of total rewards: 11
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```

```
EPISODE  997
Score of total rewards: 7
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EPISODE  998
Score of total rewards: 12
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EPISODE  999
Score of total rewards: 8
Average score over time: 7.954
```

In [67]:
```python
# only to have a look of the test play result
my_q_agent_controlled.test(test_episodes=5, display=True)
```


Taxi-v3 | Episode: 4 | Step: 15
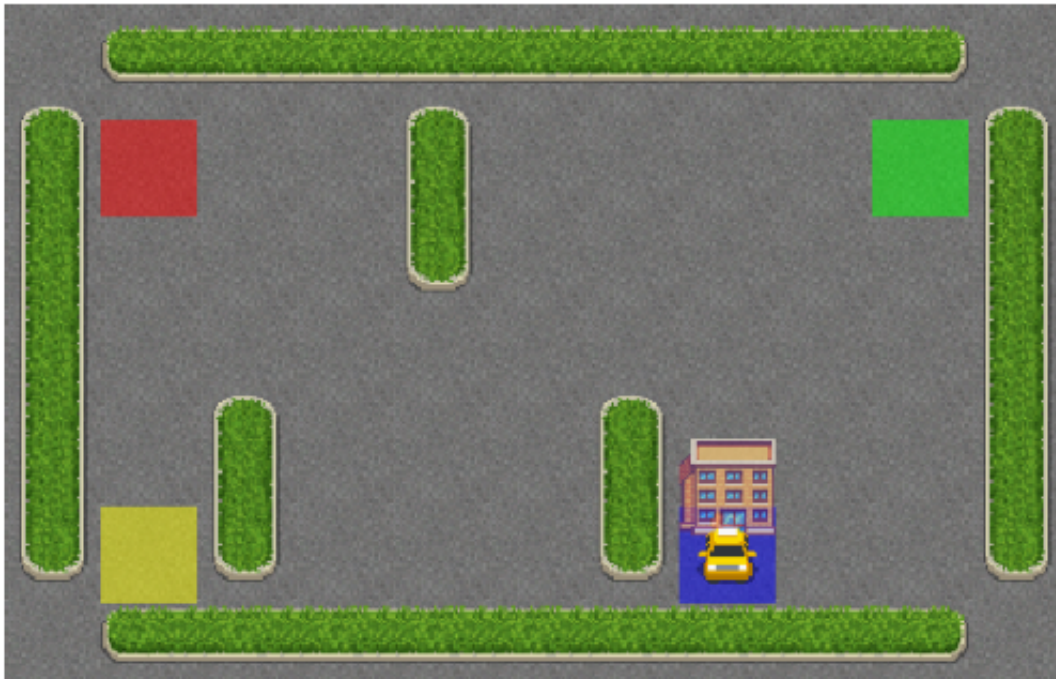
```
Score of total rewards: 6
Average score over time: 8.6
```

Out[67]: [7, 10, 10, 10, 6]

Taxi-v3 | Episode: 4 | Step: 15
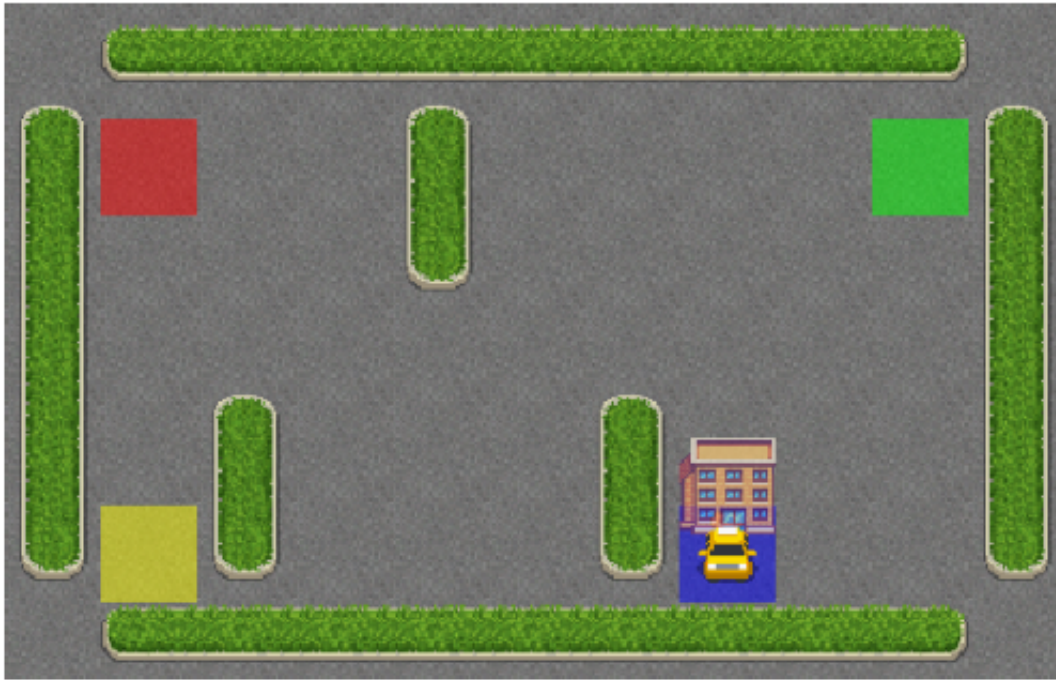
In [68]:
```
# save to GIF
my_q_agent_controlled.test_to_gif(filename="taxi_q_controlled",episodes=5
```

```
episodes: 0, acton: 3, state: 263
episodes: 0, acton: 3, state: 243
episodes: 0, acton: 1, state: 223
episodes: 0, acton: 3, state: 123
episodes: 0, acton: 1, state: 103
episodes: 0, acton: 4, state: 3
episodes: 0, acton: 0, state: 19
episodes: 0, acton: 0, state: 119
episodes: 0, acton: 2, state: 219
episodes: 0, acton: 2, state: 239
episodes: 0, acton: 2, state: 259
episodes: 0, acton: 0, state: 279
episodes: 0, acton: 0, state: 379
episodes: 0, acton: 5, state: 479
episodes: 1, acton: 1, state: 486
episodes: 1, acton: 1, state: 386
episodes: 1, acton: 1, state: 286
episodes: 1, acton: 1, state: 186
episodes: 1, acton: 4, state: 86
episodes: 1, acton: 0, state: 98
episodes: 1, acton: 3, state: 198
episodes: 1, acton: 3, state: 178
episodes: 1, acton: 0, state: 158
episodes: 1, acton: 3, state: 258
episodes: 1, acton: 3, state: 238
episodes: 1, acton: 0, state: 218
episodes: 1, acton: 0, state: 318
episodes: 1, acton: 5, state: 418
episodes: 2, acton: 1, state: 264
episodes: 2, acton: 1, state: 164
episodes: 2, acton: 2, state: 64
episodes: 2, acton: 4, state: 84
```

```
episodes: 2, acton: 3, state: 96
episodes: 2, acton: 3, state: 76
episodes: 2, acton: 0, state: 56
episodes: 2, acton: 0, state: 156
episodes: 2, acton: 3, state: 256
episodes: 2, acton: 3, state: 236
episodes: 2, acton: 1, state: 216
episodes: 2, acton: 1, state: 116
episodes: 2, acton: 5, state: 16
episodes: 3, acton: 1, state: 287
episodes: 3, acton: 1, state: 187
episodes: 3, acton: 4, state: 87
episodes: 3, acton: 3, state: 99
episodes: 3, acton: 0, state: 79
episodes: 3, acton: 0, state: 179
episodes: 3, acton: 0, state: 279
episodes: 3, acton: 0, state: 379
episodes: 3, acton: 5, state: 479
episodes: 4, acton: 0, state: 183
episodes: 4, acton: 3, state: 283
episodes: 4, acton: 3, state: 263
episodes: 4, acton: 3, state: 243
episodes: 4, acton: 1, state: 223
episodes: 4, acton: 3, state: 123
episodes: 4, acton: 1, state: 103
episodes: 4, acton: 4, state: 3
episodes: 4, acton: 0, state: 19
episodes: 4, acton: 0, state: 119
episodes: 4, acton: 2, state: 219
episodes: 4, acton: 2, state: 239
episodes: 4, acton: 2, state: 259
episodes: 4, acton: 0, state: 279
episodes: 4, acton: 0, state: 379
episodes: 4, acton: 5, state: 479
Saving gif...Done!
```

In [69]:
```python
# display the captured GIF
display.Image(data=open("./gifs/taxi_q_controlled.gif",'rb').read(), form
# "taxi_q_controlled"
```

Out[69]: `<IPython.core.display.Image object>`

If the above display function is not working, here is the previously prepared taxi_q_controlled.gif

DQN Agent with Controlled Parameters

In [71]:
```
%%time
my_dqn_agent_controlled_avg_reward_lst = my_dqn_agent_controlled.test(tes
```

```
Policy (trained policy network model from the .pt file):
State 000, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 001, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 002, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 003, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 004, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 005, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 006, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
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/var/folders/dr/jfnhclyj0t1gmk794dvj4zgm0000gn/T/ipykernel_9558/268710954
0.py:221: FutureWarning: You are using `torch.load` with `weights_only=Fal
se` (the current default value), which uses the default pickle module impl
icitly. It is possible to construct malicious pickle data which will execu
te arbitrary code during unpickling (See https://github.com/pytorch/pytorc
h/blob/main/SECURITY.md#untrusted-models for more details). In a future re
lease, the default value for `weights_only` will be flipped to `True`. Thi
s limits the functions that could be executed during unpickling. Arbitrary
objects will no longer be allowed to be loaded via this mode unless they a
re explicitly allowlisted by the user via `torch.serialization.add_safe_gl
obals`. We recommend you start setting `weights_only=True` for any use cas
e where you don't have full control of the loaded file. Please open an iss
ue on GitHub for any issues related to this experimental feature.
  policy_dqn.load_state_dict(torch.load(self.result_model_name + ".pt")) #
"taxi_dql.pt"))
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Episode 997: Total Reward = −200
Episode 998: Total Reward = −200
Episode 999: Total Reward = −200
Episode 1000: Total Reward = −200
Average Reward across all Episodes: = −200.0
CPU times: user 8.19 s, sys: 91.5 ms, total: 8.28 s
Wall time: 7.74 s
```

In [72]:
```python
# # only to have a look of the test play result
my_dqn_agent_controlled.test(test_episodes=5, display=True)
```


Taxi-v3 | Episode: 4 | Step: 200
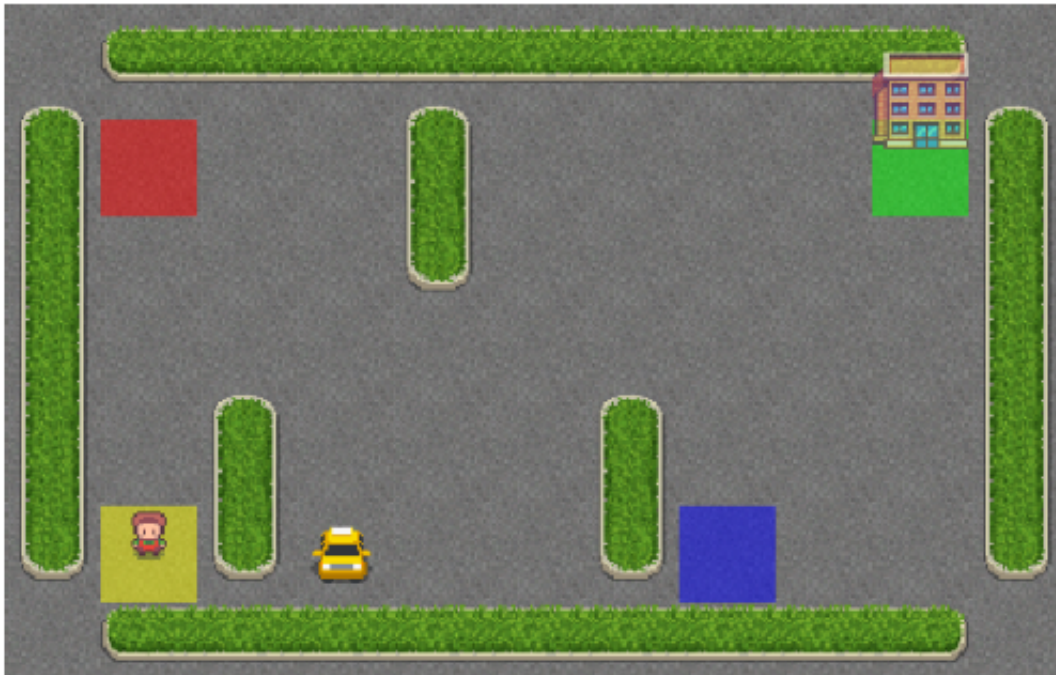
```
Episode 5: Total Reward = −200
Average Reward across all Episodes: = −200.0
```

Out[72]: [−200, −200, −200, −200, −200]

Taxi-v3 | Episode: 4 | Step: 200
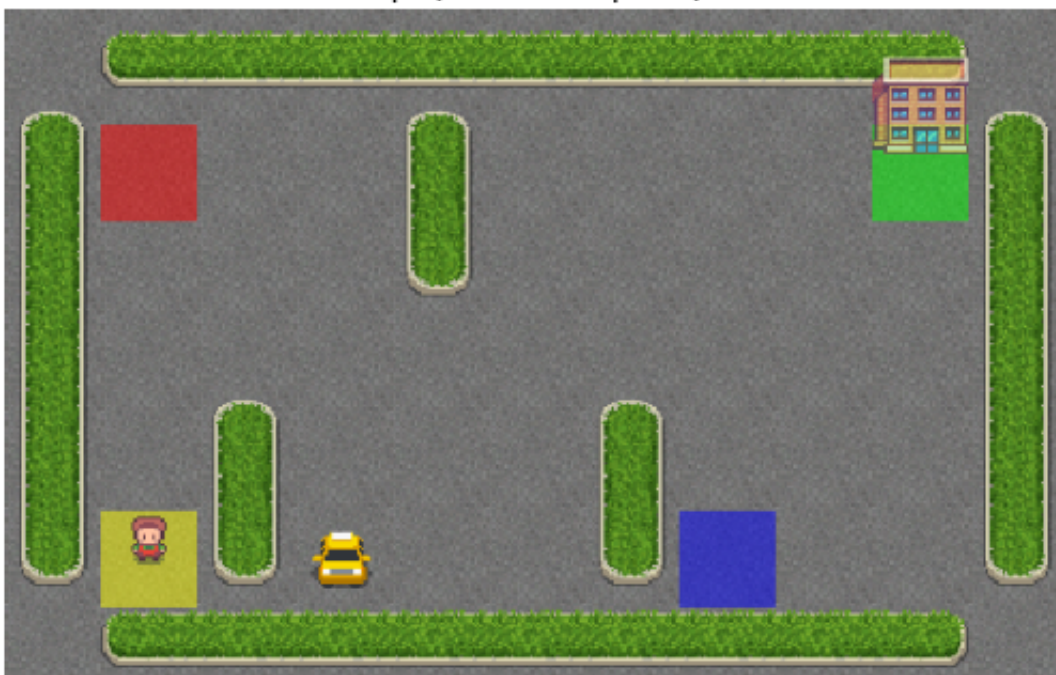
```
In [73]: my_dqn_agent_controlled.test_to_gif(filename="taxi_dqn_controlled",episod
```

```
Policy (trained):
State 000, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 001, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 002, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 003, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 004, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 005, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 006, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 007, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 008, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 009, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 010, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 011, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 012, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 013, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 014, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 015, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 016, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 017, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
State 018, Action S, Q-values: [-19.46 -19.50 -19.48 -19.50 -28.75 -28.24]
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Episode 3: Total Reward = -200
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Episode 5: Total Reward = -200
Saving gif...Done!
Average Reward across all Episodes: = -200.0
```

In [74]:
```python
# display the captured GIF
display.Image(data=open("./gifs/taxi_dqn_controlled.gif",'rb').read(), fo
# "taxi_q_controlled"
```

Out[74]: <IPython.core.display.Image object>

If the above display function is not working, here is the previously prepared taxi_dqn_controlled.gif
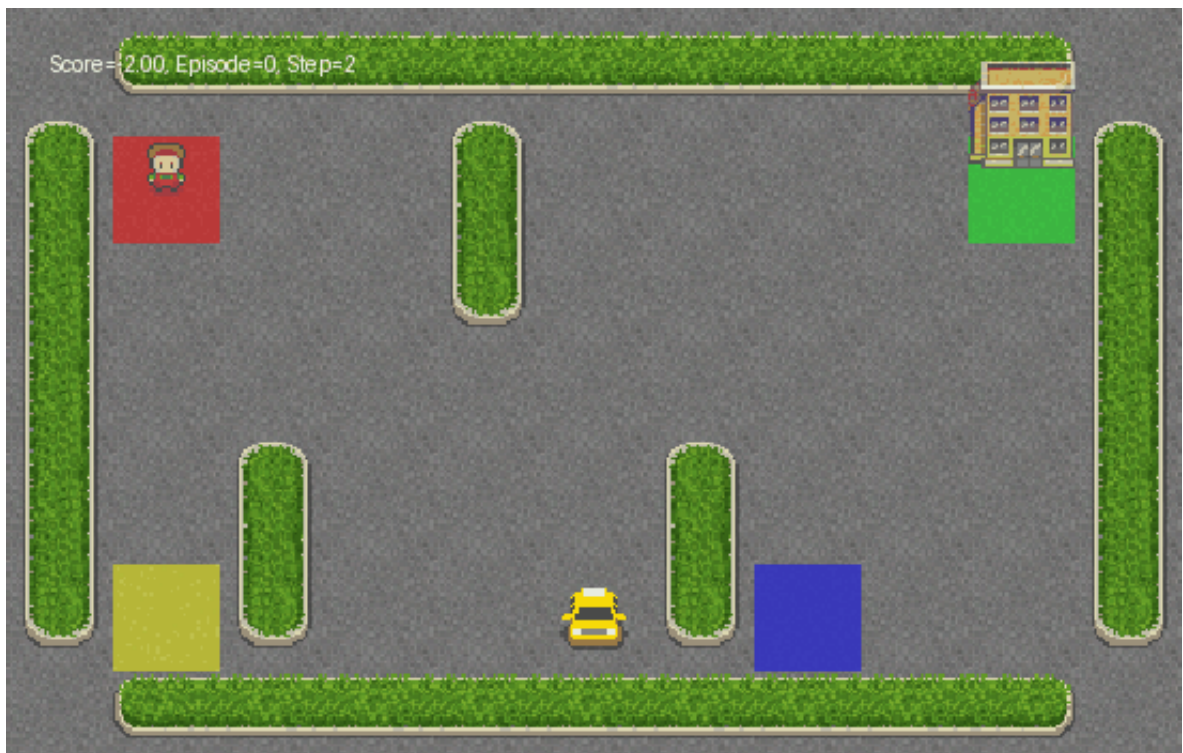
Compare the prediction of controlled models

```
In [82]: #my_q_agent_controlled_avg_reward_lst
         #my_dqn_agent_controlled_avg_reward_lst
```

```
In [94]: x = range(1,1000 + 1)

         plt.figure(figsize=(10, 6))
         plt.plot(x, my_dqn_agent_controlled_avg_reward_lst, label='DQN', marker='
         plt.plot(x, my_q_agent_controlled_avg_reward_lst, label='Q-learning', mar

         # titles and labels
         plt.title('Training Comparison (Controlled Parameters)')
         plt.xlabel('Time Episodes')
         plt.ylabel('Average Reward')
         plt.legend()
         # display
         plt.grid(True)
         plt.show()
```

Training Comparison (Controlled Parameters)
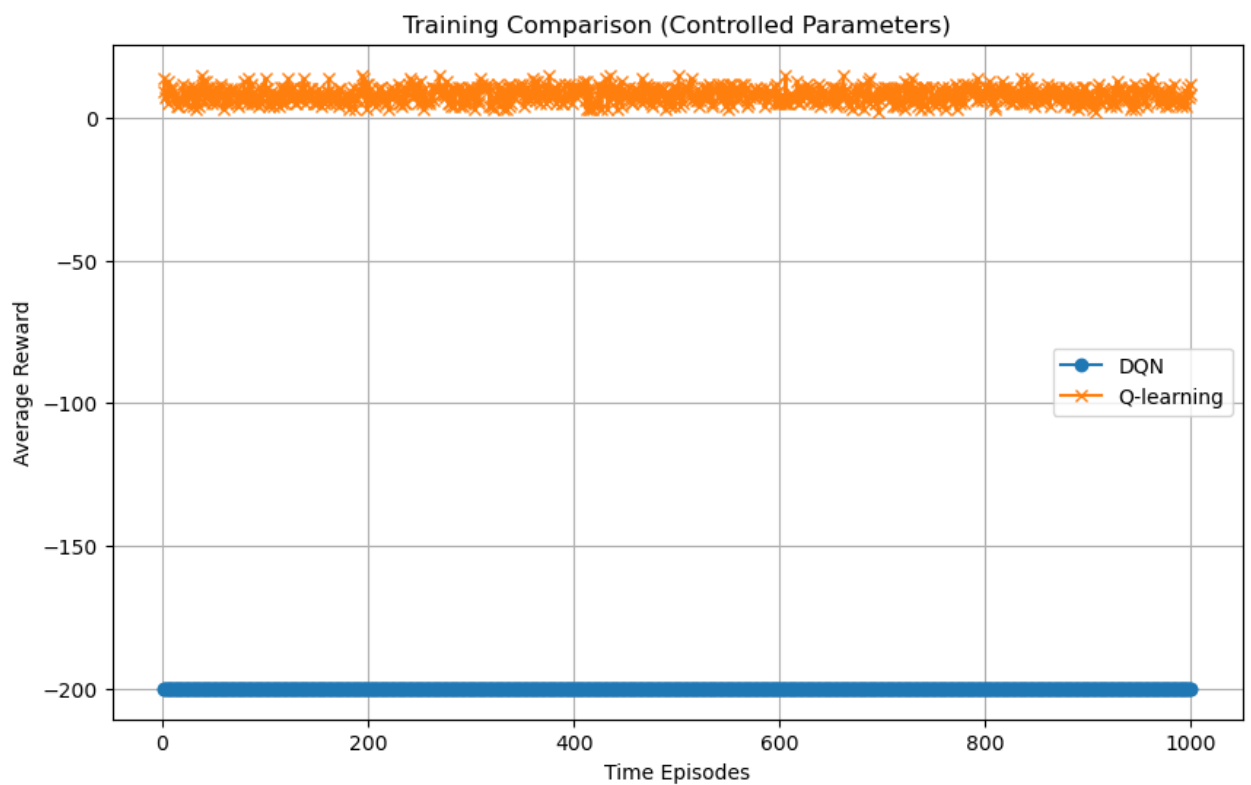
Fine-tunred Parameter Training

Q Learning Agent with Fine-Tuned Parameters

```
In [96]:  my_q_agent_fine_tuned = QLearningAgent(game_id="Taxi-v3", render_mode="rg
                                  gamma=0.90, alpha=0.5, epsilon=1.0
                                  epsilon_decay=1000, epsilon_end=0.
                                  result_model_name="taxi_q_fine_tun
```

```
In [98]:  %%time
          my_q_agent_fine_tuned_training_rewards = my_q_agent_fine_tuned.train(1000
```

```
Episode 100/100000, Avg Reward: -491.49, Epsilon: 0.29
Episode 200/100000, Avg Reward: -121.39, Epsilon: 0.16
Episode 300/100000, Avg Reward: -32.13, Epsilon: 0.12
Episode 400/100000, Avg Reward: -6.31, Epsilon: 0.11
Episode 500/100000, Avg Reward: 0.30, Epsilon: 0.10
Episode 600/100000, Avg Reward: 2.72, Epsilon: 0.09
Episode 700/100000, Avg Reward: 2.70, Epsilon: 0.08
Episode 800/100000, Avg Reward: 2.66, Epsilon: 0.07
Episode 900/100000, Avg Reward: 4.39, Epsilon: 0.06
Episode 1000/100000, Avg Reward: 3.42, Epsilon: 0.06
Episode 1100/100000, Avg Reward: 4.94, Epsilon: 0.05
Episode 1200/100000, Avg Reward: 6.57, Epsilon: 0.05
Episode 1300/100000, Avg Reward: 5.81, Epsilon: 0.04
Episode 1400/100000, Avg Reward: 5.56, Epsilon: 0.04
Episode 1500/100000, Avg Reward: 6.15, Epsilon: 0.04
Episode 1600/100000, Avg Reward: 6.40, Epsilon: 0.03
Episode 1700/100000, Avg Reward: 5.56, Epsilon: 0.03
Episode 1800/100000, Avg Reward: 5.70, Epsilon: 0.03
Episode 1900/100000, Avg Reward: 6.07, Epsilon: 0.02
Episode 2000/100000, Avg Reward: 5.92, Epsilon: 0.02
Episode 2100/100000, Avg Reward: 6.34, Epsilon: 0.02
```

```
Episode 2200/100000, Avg Reward: 6.31, Epsilon: 0.02
Episode 2300/100000, Avg Reward: 7.37, Epsilon: 0.02
Episode 2400/100000, Avg Reward: 6.64, Epsilon: 0.02
Episode 2500/100000, Avg Reward: 7.56, Epsilon: 0.01
Episode 2600/100000, Avg Reward: 7.23, Epsilon: 0.01
Episode 2700/100000, Avg Reward: 6.99, Epsilon: 0.01
Episode 2800/100000, Avg Reward: 7.21, Epsilon: 0.01
Episode 2900/100000, Avg Reward: 7.06, Epsilon: 0.01
Episode 3000/100000, Avg Reward: 7.32, Epsilon: 0.01
Episode 3100/100000, Avg Reward: 7.70, Epsilon: 0.01
Episode 3200/100000, Avg Reward: 7.29, Epsilon: 0.01
Episode 3300/100000, Avg Reward: 7.55, Epsilon: 0.01
Episode 3400/100000, Avg Reward: 7.74, Epsilon: 0.01
Episode 3500/100000, Avg Reward: 7.44, Epsilon: 0.01
Episode 3600/100000, Avg Reward: 7.36, Epsilon: 0.01
Episode 3700/100000, Avg Reward: 8.04, Epsilon: 0.00
Episode 3800/100000, Avg Reward: 7.27, Epsilon: 0.00
Episode 3900/100000, Avg Reward: 7.75, Epsilon: 0.00
Episode 4000/100000, Avg Reward: 7.76, Epsilon: 0.00
Episode 4100/100000, Avg Reward: 8.30, Epsilon: 0.00
Episode 4200/100000, Avg Reward: 7.76, Epsilon: 0.00
Episode 4300/100000, Avg Reward: 7.66, Epsilon: 0.00
Episode 4400/100000, Avg Reward: 7.42, Epsilon: 0.00
Episode 4500/100000, Avg Reward: 8.21, Epsilon: 0.00
Episode 4600/100000, Avg Reward: 7.62, Epsilon: 0.00
Episode 4700/100000, Avg Reward: 7.85, Epsilon: 0.00
Episode 4800/100000, Avg Reward: 7.51, Epsilon: 0.00
Episode 4900/100000, Avg Reward: 7.89, Epsilon: 0.00
Episode 5000/100000, Avg Reward: 7.51, Epsilon: 0.00
Episode 5100/100000, Avg Reward: 8.29, Epsilon: 0.00
Episode 5200/100000, Avg Reward: 7.86, Epsilon: 0.00
Episode 5300/100000, Avg Reward: 8.36, Epsilon: 0.00
Episode 5400/100000, Avg Reward: 7.96, Epsilon: 0.00
Episode 5500/100000, Avg Reward: 7.99, Epsilon: 0.00
Episode 5600/100000, Avg Reward: 7.66, Epsilon: 0.00
Episode 5700/100000, Avg Reward: 8.27, Epsilon: 0.00
Episode 5800/100000, Avg Reward: 7.63, Epsilon: 0.00
Episode 5900/100000, Avg Reward: 7.64, Epsilon: 0.00
Episode 6000/100000, Avg Reward: 7.79, Epsilon: 0.00
Episode 6100/100000, Avg Reward: 7.97, Epsilon: 0.00
Episode 6200/100000, Avg Reward: 7.75, Epsilon: 0.00
Episode 6300/100000, Avg Reward: 7.67, Epsilon: 0.00
Episode 6400/100000, Avg Reward: 7.36, Epsilon: 0.00
Episode 6500/100000, Avg Reward: 7.72, Epsilon: 0.00
Episode 6600/100000, Avg Reward: 7.35, Epsilon: 0.00
Episode 6700/100000, Avg Reward: 8.02, Epsilon: 0.00
Episode 6800/100000, Avg Reward: 7.68, Epsilon: 0.00
Episode 6900/100000, Avg Reward: 8.30, Epsilon: 0.00
Episode 7000/100000, Avg Reward: 7.95, Epsilon: 0.00
Episode 7100/100000, Avg Reward: 7.87, Epsilon: 0.00
Episode 7200/100000, Avg Reward: 7.92, Epsilon: 0.00
Episode 7300/100000, Avg Reward: 7.56, Epsilon: 0.00
Episode 7400/100000, Avg Reward: 8.38, Epsilon: 0.00
Episode 7500/100000, Avg Reward: 7.74, Epsilon: 0.00
Episode 7600/100000, Avg Reward: 8.17, Epsilon: 0.00
Episode 7700/100000, Avg Reward: 8.03, Epsilon: 0.00
Episode 7800/100000, Avg Reward: 8.08, Epsilon: 0.00
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Episode 8000/100000, Avg Reward: 7.91, Epsilon: 0.00
Episode 8100/100000, Avg Reward: 8.29, Epsilon: 0.00
Episode 8200/100000, Avg Reward: 8.22, Epsilon: 0.00
Episode 8300/100000, Avg Reward: 7.75, Epsilon: 0.00
Episode 8400/100000, Avg Reward: 7.82, Epsilon: 0.00
Episode 8500/100000, Avg Reward: 8.00, Epsilon: 0.00
Episode 8600/100000, Avg Reward: 7.93, Epsilon: 0.00
Episode 8700/100000, Avg Reward: 7.86, Epsilon: 0.00
Episode 8800/100000, Avg Reward: 8.10, Epsilon: 0.00
Episode 8900/100000, Avg Reward: 8.19, Epsilon: 0.00
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Episode 9700/100000, Avg Reward: 7.95, Epsilon: 0.00
Episode 9800/100000, Avg Reward: 7.65, Epsilon: 0.00
Episode 9900/100000, Avg Reward: 8.39, Epsilon: 0.00
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Episode 13500/100000, Avg Reward: 7.78, Epsilon: 0.00
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Episode 18800/100000, Avg Reward: 8.56, Epsilon: 0.00
Episode 18900/100000, Avg Reward: 8.00, Epsilon: 0.00
Episode 19000/100000, Avg Reward: 7.88, Epsilon: 0.00
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Episode 19300/100000, Avg Reward: 7.62, Epsilon: 0.00
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Episode 19600/100000, Avg Reward: 7.78, Epsilon: 0.00
Episode 19700/100000, Avg Reward: 8.10, Epsilon: 0.00
Episode 19800/100000, Avg Reward: 7.78, Epsilon: 0.00
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Episode 20400/100000, Avg Reward: 7.57, Epsilon: 0.00
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Episode 20900/100000, Avg Reward: 7.96, Epsilon: 0.00
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Episode 21200/100000, Avg Reward: 7.56, Epsilon: 0.00
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Episode 21400/100000, Avg Reward: 7.81, Epsilon: 0.00
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Episode 21600/100000, Avg Reward: 7.82, Epsilon: 0.00
Episode 21700/100000, Avg Reward: 8.11, Epsilon: 0.00
Episode 21800/100000, Avg Reward: 8.12, Epsilon: 0.00
Episode 21900/100000, Avg Reward: 8.18, Epsilon: 0.00
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Episode 22200/100000, Avg Reward: 7.57, Epsilon: 0.00
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Episode 22500/100000, Avg Reward: 7.56, Epsilon: 0.00
Episode 22600/100000, Avg Reward: 8.05, Epsilon: 0.00
Episode 22700/100000, Avg Reward: 7.94, Epsilon: 0.00
Episode 22800/100000, Avg Reward: 7.70, Epsilon: 0.00
Episode 22900/100000, Avg Reward: 8.16, Epsilon: 0.00
Episode 23000/100000, Avg Reward: 7.75, Epsilon: 0.00
Episode 23100/100000, Avg Reward: 7.65, Epsilon: 0.00
Episode 23200/100000, Avg Reward: 7.75, Epsilon: 0.00
Episode 23300/100000, Avg Reward: 7.80, Epsilon: 0.00
Episode 23400/100000, Avg Reward: 7.54, Epsilon: 0.00
Episode 23500/100000, Avg Reward: 7.45, Epsilon: 0.00
Episode 23600/100000, Avg Reward: 7.50, Epsilon: 0.00
Episode 23700/100000, Avg Reward: 7.86, Epsilon: 0.00
Episode 23800/100000, Avg Reward: 7.91, Epsilon: 0.00
Episode 23900/100000, Avg Reward: 8.00, Epsilon: 0.00
Episode 24000/100000, Avg Reward: 7.97, Epsilon: 0.00
Episode 24100/100000, Avg Reward: 7.83, Epsilon: 0.00
Episode 24200/100000, Avg Reward: 7.63, Epsilon: 0.00
Episode 24300/100000, Avg Reward: 7.88, Epsilon: 0.00
Episode 24400/100000, Avg Reward: 7.82, Epsilon: 0.00
Episode 24500/100000, Avg Reward: 7.95, Epsilon: 0.00
Episode 24600/100000, Avg Reward: 7.45, Epsilon: 0.00
Episode 24700/100000, Avg Reward: 8.15, Epsilon: 0.00
Episode 24800/100000, Avg Reward: 7.72, Epsilon: 0.00
Episode 24900/100000, Avg Reward: 8.00, Epsilon: 0.00
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Episode 25000/100000, Avg Reward: 7.36, Epsilon: 0.00
Episode 25100/100000, Avg Reward: 7.77, Epsilon: 0.00
Episode 25200/100000, Avg Reward: 7.76, Epsilon: 0.00
Episode 25300/100000, Avg Reward: 7.67, Epsilon: 0.00
Episode 25400/100000, Avg Reward: 8.03, Epsilon: 0.00
Episode 25500/100000, Avg Reward: 7.53, Epsilon: 0.00
Episode 25600/100000, Avg Reward: 7.75, Epsilon: 0.00
Episode 25700/100000, Avg Reward: 7.68, Epsilon: 0.00
Episode 25800/100000, Avg Reward: 7.76, Epsilon: 0.00
Episode 25900/100000, Avg Reward: 8.07, Epsilon: 0.00
Episode 26000/100000, Avg Reward: 7.90, Epsilon: 0.00
Episode 26100/100000, Avg Reward: 7.82, Epsilon: 0.00
Episode 26200/100000, Avg Reward: 7.51, Epsilon: 0.00
Episode 26300/100000, Avg Reward: 8.40, Epsilon: 0.00
Episode 26400/100000, Avg Reward: 8.02, Epsilon: 0.00
Episode 26500/100000, Avg Reward: 7.86, Epsilon: 0.00
Episode 26600/100000, Avg Reward: 7.92, Epsilon: 0.00
Episode 26700/100000, Avg Reward: 7.69, Epsilon: 0.00
Episode 26800/100000, Avg Reward: 8.06, Epsilon: 0.00
Episode 26900/100000, Avg Reward: 7.72, Epsilon: 0.00
Episode 27000/100000, Avg Reward: 7.91, Epsilon: 0.00
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Episode 27200/100000, Avg Reward: 8.16, Epsilon: 0.00
Episode 27300/100000, Avg Reward: 7.49, Epsilon: 0.00
Episode 27400/100000, Avg Reward: 8.13, Epsilon: 0.00
Episode 27500/100000, Avg Reward: 8.02, Epsilon: 0.00
Episode 27600/100000, Avg Reward: 8.16, Epsilon: 0.00
Episode 27700/100000, Avg Reward: 7.96, Epsilon: 0.00
Episode 27800/100000, Avg Reward: 8.04, Epsilon: 0.00
Episode 27900/100000, Avg Reward: 7.59, Epsilon: 0.00
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Episode 28100/100000, Avg Reward: 8.03, Epsilon: 0.00
Episode 28200/100000, Avg Reward: 8.04, Epsilon: 0.00
Episode 28300/100000, Avg Reward: 8.19, Epsilon: 0.00
Episode 28400/100000, Avg Reward: 7.97, Epsilon: 0.00
Episode 28500/100000, Avg Reward: 7.56, Epsilon: 0.00
Episode 28600/100000, Avg Reward: 7.71, Epsilon: 0.00
Episode 28700/100000, Avg Reward: 7.77, Epsilon: 0.00
Episode 28800/100000, Avg Reward: 7.56, Epsilon: 0.00
Episode 28900/100000, Avg Reward: 7.95, Epsilon: 0.00
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Episode 29300/100000, Avg Reward: 7.44, Epsilon: 0.00
Episode 29400/100000, Avg Reward: 7.72, Epsilon: 0.00
Episode 29500/100000, Avg Reward: 7.98, Epsilon: 0.00
Episode 29600/100000, Avg Reward: 7.93, Epsilon: 0.00
Episode 29700/100000, Avg Reward: 7.86, Epsilon: 0.00
Episode 29800/100000, Avg Reward: 8.07, Epsilon: 0.00
Episode 29900/100000, Avg Reward: 7.64, Epsilon: 0.00
Episode 30000/100000, Avg Reward: 7.95, Epsilon: 0.00
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Episode 30300/100000, Avg Reward: 8.00, Epsilon: 0.00
Episode 30400/100000, Avg Reward: 7.43, Epsilon: 0.00
Episode 30500/100000, Avg Reward: 7.80, Epsilon: 0.00
Episode 30600/100000, Avg Reward: 8.04, Epsilon: 0.00
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Episode 30700/100000, Avg Reward: 7.74, Epsilon: 0.00
Episode 30800/100000, Avg Reward: 8.22, Epsilon: 0.00
Episode 30900/100000, Avg Reward: 8.11, Epsilon: 0.00
Episode 31000/100000, Avg Reward: 7.72, Epsilon: 0.00
Episode 31100/100000, Avg Reward: 7.88, Epsilon: 0.00
Episode 31200/100000, Avg Reward: 8.00, Epsilon: 0.00
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Episode 31400/100000, Avg Reward: 7.89, Epsilon: 0.00
Episode 31500/100000, Avg Reward: 8.15, Epsilon: 0.00
Episode 31600/100000, Avg Reward: 7.83, Epsilon: 0.00
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Episode 31900/100000, Avg Reward: 8.25, Epsilon: 0.00
Episode 32000/100000, Avg Reward: 8.11, Epsilon: 0.00
Episode 32100/100000, Avg Reward: 7.80, Epsilon: 0.00
Episode 32200/100000, Avg Reward: 8.17, Epsilon: 0.00
Episode 32300/100000, Avg Reward: 8.04, Epsilon: 0.00
Episode 32400/100000, Avg Reward: 7.72, Epsilon: 0.00
Episode 32500/100000, Avg Reward: 8.19, Epsilon: 0.00
Episode 32600/100000, Avg Reward: 8.04, Epsilon: 0.00
Episode 32700/100000, Avg Reward: 8.15, Epsilon: 0.00
Episode 32800/100000, Avg Reward: 7.54, Epsilon: 0.00
Episode 32900/100000, Avg Reward: 7.74, Epsilon: 0.00
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Episode 33100/100000, Avg Reward: 7.81, Epsilon: 0.00
Episode 33200/100000, Avg Reward: 8.02, Epsilon: 0.00
Episode 33300/100000, Avg Reward: 7.71, Epsilon: 0.00
Episode 33400/100000, Avg Reward: 7.58, Epsilon: 0.00
Episode 33500/100000, Avg Reward: 8.24, Epsilon: 0.00
Episode 33600/100000, Avg Reward: 7.42, Epsilon: 0.00
Episode 33700/100000, Avg Reward: 8.06, Epsilon: 0.00
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Episode 34000/100000, Avg Reward: 7.60, Epsilon: 0.00
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Episode 34200/100000, Avg Reward: 8.19, Epsilon: 0.00
Episode 34300/100000, Avg Reward: 8.18, Epsilon: 0.00
Episode 34400/100000, Avg Reward: 7.96, Epsilon: 0.00
Episode 34500/100000, Avg Reward: 7.98, Epsilon: 0.00
Episode 34600/100000, Avg Reward: 8.25, Epsilon: 0.00
Episode 34700/100000, Avg Reward: 7.86, Epsilon: 0.00
Episode 34800/100000, Avg Reward: 8.05, Epsilon: 0.00
Episode 34900/100000, Avg Reward: 7.68, Epsilon: 0.00
Episode 35000/100000, Avg Reward: 8.04, Epsilon: 0.00
Episode 35100/100000, Avg Reward: 8.25, Epsilon: 0.00
Episode 35200/100000, Avg Reward: 7.68, Epsilon: 0.00
Episode 35300/100000, Avg Reward: 8.31, Epsilon: 0.00
Episode 35400/100000, Avg Reward: 7.73, Epsilon: 0.00
Episode 35500/100000, Avg Reward: 7.09, Epsilon: 0.00
Episode 35600/100000, Avg Reward: 8.07, Epsilon: 0.00
Episode 35700/100000, Avg Reward: 8.25, Epsilon: 0.00
Episode 35800/100000, Avg Reward: 7.51, Epsilon: 0.00
Episode 35900/100000, Avg Reward: 8.09, Epsilon: 0.00
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Episode 36100/100000, Avg Reward: 7.35, Epsilon: 0.00
Episode 36200/100000, Avg Reward: 7.70, Epsilon: 0.00
Episode 36300/100000, Avg Reward: 8.10, Epsilon: 0.00
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Episode 36500/100000, Avg Reward: 8.12, Epsilon: 0.00
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Episode 36900/100000, Avg Reward: 8.35, Epsilon: 0.00
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Episode 37200/100000, Avg Reward: 8.09, Epsilon: 0.00
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Episode 37400/100000, Avg Reward: 7.77, Epsilon: 0.00
Episode 37500/100000, Avg Reward: 8.30, Epsilon: 0.00
Episode 37600/100000, Avg Reward: 7.92, Epsilon: 0.00
Episode 37700/100000, Avg Reward: 7.82, Epsilon: 0.00
Episode 37800/100000, Avg Reward: 7.78, Epsilon: 0.00
Episode 37900/100000, Avg Reward: 7.79, Epsilon: 0.00
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Episode 38200/100000, Avg Reward: 7.73, Epsilon: 0.00
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Episode 38700/100000, Avg Reward: 7.53, Epsilon: 0.00
Episode 38800/100000, Avg Reward: 8.30, Epsilon: 0.00
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Episode 39200/100000, Avg Reward: 8.42, Epsilon: 0.00
Episode 39300/100000, Avg Reward: 7.87, Epsilon: 0.00
Episode 39400/100000, Avg Reward: 7.66, Epsilon: 0.00
Episode 39500/100000, Avg Reward: 8.01, Epsilon: 0.00
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Episode 39700/100000, Avg Reward: 7.94, Epsilon: 0.00
Episode 39800/100000, Avg Reward: 7.90, Epsilon: 0.00
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Episode 40500/100000, Avg Reward: 7.99, Epsilon: 0.00
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Episode 40800/100000, Avg Reward: 8.30, Epsilon: 0.00
Episode 40900/100000, Avg Reward: 7.91, Epsilon: 0.00
Episode 41000/100000, Avg Reward: 7.94, Epsilon: 0.00
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Episode 41200/100000, Avg Reward: 7.83, Epsilon: 0.00
Episode 41300/100000, Avg Reward: 7.83, Epsilon: 0.00
Episode 41400/100000, Avg Reward: 7.61, Epsilon: 0.00
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Episode 41600/100000, Avg Reward: 7.88, Epsilon: 0.00
Episode 41700/100000, Avg Reward: 7.97, Epsilon: 0.00
Episode 41800/100000, Avg Reward: 7.41, Epsilon: 0.00
Episode 41900/100000, Avg Reward: 7.69, Epsilon: 0.00
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Episode 42400/100000, Avg Reward: 8.14, Epsilon: 0.00
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Episode 42600/100000, Avg Reward: 7.42, Epsilon: 0.00
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Episode 47700/100000, Avg Reward: 7.92, Epsilon: 0.00
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Episode 47900/100000, Avg Reward: 8.17, Epsilon: 0.00
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Episode 52900/100000, Avg Reward: 7.91, Epsilon: 0.00
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Episode 54500/100000, Avg Reward: 8.01, Epsilon: 0.00
Episode 54600/100000, Avg Reward: 7.67, Epsilon: 0.00
Episode 54700/100000, Avg Reward: 8.11, Epsilon: 0.00
Episode 54800/100000, Avg Reward: 7.76, Epsilon: 0.00
Episode 54900/100000, Avg Reward: 7.60, Epsilon: 0.00
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Episode 55100/100000, Avg Reward: 7.74, Epsilon: 0.00
Episode 55200/100000, Avg Reward: 8.07, Epsilon: 0.00
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Episode 70500/100000, Avg Reward: 7.68, Epsilon: 0.00
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Episode 76200/100000, Avg Reward: 7.95, Epsilon: 0.00
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Episode 89300/100000, Avg Reward: 7.93, Epsilon: 0.00
Episode 89400/100000, Avg Reward: 7.54, Epsilon: 0.00
Episode 89500/100000, Avg Reward: 7.53, Epsilon: 0.00
Episode 89600/100000, Avg Reward: 7.73, Epsilon: 0.00
Episode 89700/100000, Avg Reward: 8.06, Epsilon: 0.00
Episode 89800/100000, Avg Reward: 7.76, Epsilon: 0.00
Episode 89900/100000, Avg Reward: 7.81, Epsilon: 0.00
Episode 90000/100000, Avg Reward: 8.22, Epsilon: 0.00
Episode 90100/100000, Avg Reward: 7.47, Epsilon: 0.00
Episode 90200/100000, Avg Reward: 7.82, Epsilon: 0.00
Episode 90300/100000, Avg Reward: 7.91, Epsilon: 0.00
Episode 90400/100000, Avg Reward: 7.39, Epsilon: 0.00
Episode 90500/100000, Avg Reward: 7.40, Epsilon: 0.00
Episode 90600/100000, Avg Reward: 8.33, Epsilon: 0.00
Episode 90700/100000, Avg Reward: 7.88, Epsilon: 0.00
Episode 90800/100000, Avg Reward: 7.80, Epsilon: 0.00
Episode 90900/100000, Avg Reward: 7.77, Epsilon: 0.00
Episode 91000/100000, Avg Reward: 8.16, Epsilon: 0.00
Episode 91100/100000, Avg Reward: 7.54, Epsilon: 0.00
Episode 91200/100000, Avg Reward: 7.53, Epsilon: 0.00
Episode 91300/100000, Avg Reward: 7.94, Epsilon: 0.00
Episode 91400/100000, Avg Reward: 7.83, Epsilon: 0.00
Episode 91500/100000, Avg Reward: 7.77, Epsilon: 0.00
Episode 91600/100000, Avg Reward: 7.85, Epsilon: 0.00
Episode 91700/100000, Avg Reward: 7.84, Epsilon: 0.00
Episode 91800/100000, Avg Reward: 7.89, Epsilon: 0.00
Episode 91900/100000, Avg Reward: 7.48, Epsilon: 0.00
Episode 92000/100000, Avg Reward: 7.82, Epsilon: 0.00
Episode 92100/100000, Avg Reward: 7.87, Epsilon: 0.00
Episode 92200/100000, Avg Reward: 7.31, Epsilon: 0.00
Episode 92300/100000, Avg Reward: 8.26, Epsilon: 0.00
Episode 92400/100000, Avg Reward: 8.16, Epsilon: 0.00
Episode 92500/100000, Avg Reward: 7.98, Epsilon: 0.00
Episode 92600/100000, Avg Reward: 8.15, Epsilon: 0.00
Episode 92700/100000, Avg Reward: 7.95, Epsilon: 0.00
Episode 92800/100000, Avg Reward: 7.54, Epsilon: 0.00
Episode 92900/100000, Avg Reward: 8.10, Epsilon: 0.00
Episode 93000/100000, Avg Reward: 7.81, Epsilon: 0.00
Episode 93100/100000, Avg Reward: 8.09, Epsilon: 0.00
Episode 93200/100000, Avg Reward: 7.89, Epsilon: 0.00
Episode 93300/100000, Avg Reward: 8.26, Epsilon: 0.00
```

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Episode 93400/100000, Avg Reward: 8.13, Epsilon: 0.00
Episode 93500/100000, Avg Reward: 8.11, Epsilon: 0.00
Episode 93600/100000, Avg Reward: 7.95, Epsilon: 0.00
Episode 93700/100000, Avg Reward: 7.63, Epsilon: 0.00
Episode 93800/100000, Avg Reward: 7.70, Epsilon: 0.00
Episode 93900/100000, Avg Reward: 7.99, Epsilon: 0.00
Episode 94000/100000, Avg Reward: 8.39, Epsilon: 0.00
Episode 94100/100000, Avg Reward: 7.65, Epsilon: 0.00
Episode 94200/100000, Avg Reward: 7.94, Epsilon: 0.00
Episode 94300/100000, Avg Reward: 7.87, Epsilon: 0.00
Episode 94400/100000, Avg Reward: 8.10, Epsilon: 0.00
Episode 94500/100000, Avg Reward: 8.07, Epsilon: 0.00
Episode 94600/100000, Avg Reward: 7.64, Epsilon: 0.00
Episode 94700/100000, Avg Reward: 8.24, Epsilon: 0.00
Episode 94800/100000, Avg Reward: 8.08, Epsilon: 0.00
Episode 94900/100000, Avg Reward: 8.17, Epsilon: 0.00
Episode 95000/100000, Avg Reward: 8.58, Epsilon: 0.00
Episode 95100/100000, Avg Reward: 7.57, Epsilon: 0.00
Episode 95200/100000, Avg Reward: 7.43, Epsilon: 0.00
Episode 95300/100000, Avg Reward: 8.01, Epsilon: 0.00
Episode 95400/100000, Avg Reward: 8.18, Epsilon: 0.00
Episode 95500/100000, Avg Reward: 7.68, Epsilon: 0.00
Episode 95600/100000, Avg Reward: 7.51, Epsilon: 0.00
Episode 95700/100000, Avg Reward: 7.67, Epsilon: 0.00
Episode 95800/100000, Avg Reward: 7.73, Epsilon: 0.00
Episode 95900/100000, Avg Reward: 7.53, Epsilon: 0.00
Episode 96000/100000, Avg Reward: 7.59, Epsilon: 0.00
Episode 96100/100000, Avg Reward: 7.53, Epsilon: 0.00
Episode 96200/100000, Avg Reward: 7.93, Epsilon: 0.00
Episode 96300/100000, Avg Reward: 7.92, Epsilon: 0.00
Episode 96400/100000, Avg Reward: 8.13, Epsilon: 0.00
Episode 96500/100000, Avg Reward: 7.67, Epsilon: 0.00
Episode 96600/100000, Avg Reward: 7.55, Epsilon: 0.00
Episode 96700/100000, Avg Reward: 7.77, Epsilon: 0.00
Episode 96800/100000, Avg Reward: 8.03, Epsilon: 0.00
Episode 96900/100000, Avg Reward: 7.07, Epsilon: 0.00
Episode 97000/100000, Avg Reward: 7.70, Epsilon: 0.00
Episode 97100/100000, Avg Reward: 7.97, Epsilon: 0.00
Episode 97200/100000, Avg Reward: 7.90, Epsilon: 0.00
Episode 97300/100000, Avg Reward: 7.52, Epsilon: 0.00
Episode 97400/100000, Avg Reward: 8.45, Epsilon: 0.00
Episode 97500/100000, Avg Reward: 7.92, Epsilon: 0.00
Episode 97600/100000, Avg Reward: 8.02, Epsilon: 0.00
Episode 97700/100000, Avg Reward: 7.75, Epsilon: 0.00
Episode 97800/100000, Avg Reward: 7.91, Epsilon: 0.00
Episode 97900/100000, Avg Reward: 7.78, Epsilon: 0.00
Episode 98000/100000, Avg Reward: 7.75, Epsilon: 0.00
Episode 98100/100000, Avg Reward: 8.03, Epsilon: 0.00
Episode 98200/100000, Avg Reward: 7.93, Epsilon: 0.00
Episode 98300/100000, Avg Reward: 7.71, Epsilon: 0.00
Episode 98400/100000, Avg Reward: 7.76, Epsilon: 0.00
Episode 98500/100000, Avg Reward: 8.41, Epsilon: 0.00
Episode 98600/100000, Avg Reward: 7.90, Epsilon: 0.00
Episode 98700/100000, Avg Reward: 7.71, Epsilon: 0.00
Episode 98800/100000, Avg Reward: 7.46, Epsilon: 0.00
Episode 98900/100000, Avg Reward: 7.85, Epsilon: 0.00
Episode 99000/100000, Avg Reward: 7.88, Epsilon: 0.00
```

```
Episode 99100/100000, Avg Reward: 8.09, Epsilon: 0.00
Episode 99200/100000, Avg Reward: 8.04, Epsilon: 0.00
Episode 99300/100000, Avg Reward: 8.13, Epsilon: 0.00
Episode 99400/100000, Avg Reward: 7.90, Epsilon: 0.00
Episode 99500/100000, Avg Reward: 7.78, Epsilon: 0.00
Episode 99600/100000, Avg Reward: 7.55, Epsilon: 0.00
Episode 99700/100000, Avg Reward: 7.77, Epsilon: 0.00
Episode 99800/100000, Avg Reward: 7.49, Epsilon: 0.00
Episode 99900/100000, Avg Reward: 8.18, Epsilon: 0.00
Episode 100000/100000, Avg Reward: 7.84, Epsilon: 0.00
CPU times: user 11.9 s, sys: 614 ms, total: 12.6 s
Wall time: 11.9 s
```
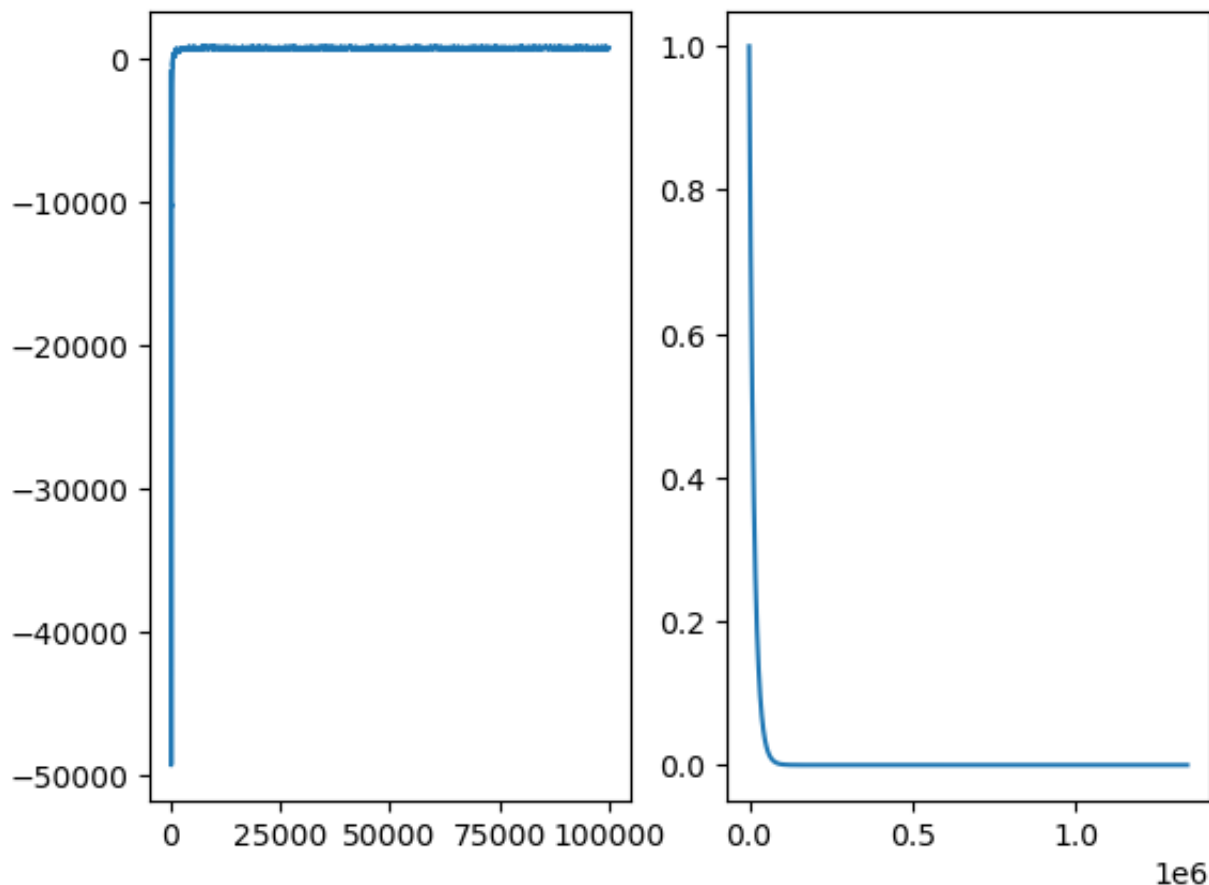

In [99]: `print(my_q_agent_fine_tuned_training_rewards)`

```
[-893. -839. -848. ...    4.    4.   12.]
```

DQN Agent with Fine-Tuned Parameters

In [101… `my_dqn_agent_fine_tuned = DQNAgent(game_id="Taxi-v3", gamma=0.90, alpha=0`
          `                               epsilon_start=1.0, epsilon_decay=1000,`
          `                               max_steps=200, render_mode="rgb_array"`

In [105… `%%time`
          `my_dqn_agent_fine_tuned_training_rewards = my_dqn_agent_fine_tuned.train(`

```
Policy (policy network model before training with randomly initialized val
ues):
State 000, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.01 -0.01]
State 001, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.02 -0.02]
State 002, Action S, Q-values: [+0.04 -0.05 +0.00 -0.06 +0.02 -0.01]
State 003, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.01 -0.01]
```

```
State 004, Action S, Q-values: [+0.04 -0.05 +0.00 -0.04 +0.01 -0.02]
State 005, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.01]
State 006, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.02 -0.01]
State 007, Action S, Q-values: [+0.04 -0.05 +0.00 -0.06 +0.02 -0.02]
State 008, Action S, Q-values: [+0.05 -0.04 +0.00 -0.05 +0.01 -0.01]
State 009, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.01]
State 010, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.02 -0.01]
State 011, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 012, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 013, Action S, Q-values: [+0.04 -0.04 -0.00 -0.06 +0.02 -0.02]
State 014, Action S, Q-values: [+0.04 -0.05 +0.01 -0.05 +0.01 -0.02]
State 015, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.01]
State 016, Action S, Q-values: [+0.05 -0.05 +0.00 -0.06 +0.01 -0.01]
State 017, Action S, Q-values: [+0.05 -0.05 -0.01 -0.06 +0.02 -0.02]
State 018, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.02 -0.01]
State 019, Action S, Q-values: [+0.04 -0.05 -0.01 -0.06 +0.03 -0.01]
State 020, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.01 -0.01]
State 021, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.01 -0.02]
State 022, Action S, Q-values: [+0.05 -0.05 -0.01 -0.05 +0.01 -0.01]
State 023, Action S, Q-values: [+0.05 -0.05 -0.01 -0.05 +0.02 -0.02]
State 024, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.01 -0.02]
State 025, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.02]
State 026, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.01 -0.01]
State 027, Action S, Q-values: [+0.04 -0.05 +0.00 -0.04 +0.01 -0.02]
State 028, Action S, Q-values: [+0.05 -0.05 -0.01 -0.05 +0.01 -0.02]
State 029, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.02 -0.02]
State 030, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.02]
State 031, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.02 -0.01]
State 032, Action S, Q-values: [+0.03 -0.05 -0.01 -0.05 +0.02 -0.02]
State 033, Action S, Q-values: [+0.04 -0.05 -0.01 -0.06 +0.02 -0.02]
State 034, Action S, Q-values: [+0.04 -0.05 -0.01 -0.06 +0.02 -0.01]
State 035, Action S, Q-values: [+0.05 -0.05 -0.00 -0.04 +0.01 -0.02]
State 036, Action S, Q-values: [+0.05 -0.04 -0.00 -0.05 +0.01 -0.02]
State 037, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.02 -0.02]
State 038, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.02]
State 039, Action S, Q-values: [+0.05 -0.05 -0.01 -0.06 +0.02 -0.01]
State 040, Action S, Q-values: [+0.05 -0.05 -0.01 -0.05 +0.01 -0.02]
State 041, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.02 -0.02]
State 042, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.01 -0.01]
State 043, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.02]
State 044, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.02]
State 045, Action S, Q-values: [+0.05 -0.06 -0.01 -0.05 +0.01 -0.01]
State 046, Action S, Q-values: [+0.04 -0.04 -0.00 -0.05 +0.01 -0.02]
State 047, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.01]
State 048, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.02]
State 049, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.02]
State 050, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.01 -0.02]
State 051, Action S, Q-values: [+0.04 -0.04 -0.00 -0.05 +0.01 -0.02]
State 052, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 053, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.02]
State 054, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.02 -0.02]
State 055, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.02 -0.01]
State 056, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 057, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 058, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.02 -0.01]
State 059, Action S, Q-values: [+0.04 -0.04 +0.00 -0.05 +0.00 -0.02]
State 060, Action S, Q-values: [+0.04 -0.05 -0.01 -0.04 +0.01 -0.02]
```

```
State 061, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.03 -0.02]
State 062, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.02 -0.01]
State 063, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.01 -0.01]
State 064, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.02]
State 065, Action S, Q-values: [+0.05 -0.04 +0.01 -0.05 +0.01 -0.01]
State 066, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.01]
State 067, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.01 -0.01]
State 068, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 069, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 070, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.01]
State 071, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.02]
State 072, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.02 -0.02]
State 073, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.02 -0.02]
State 074, Action S, Q-values: [+0.04 -0.05 +0.00 -0.06 +0.02 -0.02]
State 075, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.02]
State 076, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.01 -0.02]
State 077, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.02]
State 078, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.02 -0.02]
State 079, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.01 -0.01]
State 080, Action S, Q-values: [+0.04 -0.04 +0.00 -0.05 +0.02 -0.02]
State 081, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 082, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.02 -0.01]
State 083, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.02]
State 084, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.01 -0.01]
State 085, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.02]
State 086, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 087, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.02 -0.02]
State 088, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.02 -0.01]
State 089, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.02]
State 090, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.02]
State 091, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.02]
State 092, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.01 -0.01]
State 093, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.01 -0.02]
State 094, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.01 -0.02]
State 095, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.02 -0.02]
State 096, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.00 -0.01]
State 097, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.01 -0.02]
State 098, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.02 -0.02]
State 099, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.02 -0.01]
State 100, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.01 -0.01]
State 101, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.01]
State 102, Action S, Q-values: [+0.04 -0.05 +0.00 -0.06 +0.02 -0.02]
State 103, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.02 -0.01]
State 104, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.01]
State 105, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.01]
State 106, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.02 -0.01]
State 107, Action S, Q-values: [+0.05 -0.05 -0.00 -0.04 +0.01 -0.02]
State 108, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.02 -0.01]
State 109, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.01 -0.02]
State 110, Action S, Q-values: [+0.04 -0.05 +0.01 -0.05 +0.01 -0.02]
State 111, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.01 -0.01]
State 112, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.01 -0.01]
State 113, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.01]
State 114, Action S, Q-values: [+0.04 -0.04 +0.00 -0.05 +0.01 -0.02]
State 115, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.02 -0.02]
State 116, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.02]
State 117, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.02 -0.02]
```

```
State 118, Action S, Q-values: [+0.04 −0.05 −0.00 −0.06 +0.02 −0.02]
State 119, Action S, Q-values: [+0.04 −0.06 −0.00 −0.05 +0.02 −0.02]
State 120, Action S, Q-values: [+0.05 −0.05 −0.01 −0.06 +0.01 −0.01]
State 121, Action S, Q-values: [+0.04 −0.05 −0.00 −0.06 +0.02 −0.01]
State 122, Action S, Q-values: [+0.04 −0.05 −0.01 −0.05 +0.02 −0.02]
State 123, Action S, Q-values: [+0.04 −0.05 −0.00 −0.05 +0.02 −0.01]
State 124, Action S, Q-values: [+0.05 −0.05 −0.00 −0.05 +0.02 −0.01]
State 125, Action S, Q-values: [+0.05 −0.05 −0.00 −0.05 +0.01 −0.02]
State 126, Action S, Q-values: [+0.05 −0.05 −0.00 −0.05 +0.02 −0.01]
State 127, Action S, Q-values: [+0.05 −0.05 −0.00 −0.06 +0.02 −0.02]
State 128, Action S, Q-values: [+0.04 −0.05 −0.01 −0.05 +0.02 −0.01]
State 129, Action S, Q-values: [+0.05 −0.06 +0.00 −0.06 +0.01 −0.01]
State 130, Action S, Q-values: [+0.04 −0.05 −0.00 −0.05 +0.02 −0.02]
State 131, Action S, Q-values: [+0.04 −0.05 +0.00 −0.05 +0.01 −0.02]
State 132, Action S, Q-values: [+0.05 −0.05 −0.00 −0.05 +0.01 −0.02]
State 133, Action S, Q-values: [+0.05 −0.05 −0.00 −0.06 +0.01 −0.02]
State 134, Action S, Q-values: [+0.04 −0.05 −0.01 −0.05 +0.01 −0.01]
State 135, Action S, Q-values: [+0.05 −0.05 −0.00 −0.06 +0.02 −0.01]
State 136, Action S, Q-values: [+0.04 −0.05 −0.00 −0.05 +0.01 −0.02]
State 137, Action S, Q-values: [+0.04 −0.05 −0.00 −0.05 +0.02 −0.01]
State 138, Action S, Q-values: [+0.05 −0.05 −0.00 −0.06 +0.01 −0.02]
State 139, Action S, Q-values: [+0.05 −0.06 −0.01 −0.05 +0.01 −0.02]
State 140, Action S, Q-values: [+0.05 −0.04 −0.00 −0.05 +0.01 −0.02]
State 141, Action S, Q-values: [+0.04 −0.05 +0.00 −0.05 +0.02 −0.02]
State 142, Action S, Q-values: [+0.04 −0.05 −0.00 −0.04 +0.02 −0.02]
State 143, Action S, Q-values: [+0.04 −0.05 −0.01 −0.05 +0.02 −0.01]
State 144, Action S, Q-values: [+0.04 −0.05 −0.00 −0.05 +0.02 −0.02]
State 145, Action S, Q-values: [+0.04 −0.05 −0.01 −0.06 +0.02 −0.02]
State 146, Action S, Q-values: [+0.04 −0.05 −0.00 −0.05 +0.02 −0.02]
State 147, Action S, Q-values: [+0.04 −0.05 −0.00 −0.05 +0.01 −0.01]
State 148, Action S, Q-values: [+0.04 −0.05 +0.00 −0.05 +0.02 −0.02]
State 149, Action S, Q-values: [+0.05 −0.05 +0.00 −0.05 +0.01 −0.01]
State 150, Action S, Q-values: [+0.04 −0.05 −0.00 −0.05 +0.01 −0.02]
State 151, Action S, Q-values: [+0.04 −0.05 −0.00 −0.06 +0.02 −0.02]
State 152, Action S, Q-values: [+0.05 −0.05 −0.00 −0.05 +0.02 −0.02]
State 153, Action S, Q-values: [+0.04 −0.05 −0.01 −0.06 +0.02 −0.01]
State 154, Action S, Q-values: [+0.04 −0.05 +0.01 −0.05 +0.02 −0.02]
State 155, Action S, Q-values: [+0.05 −0.06 −0.00 −0.05 +0.02 −0.01]
State 156, Action S, Q-values: [+0.05 −0.05 −0.01 −0.06 +0.01 −0.01]
State 157, Action S, Q-values: [+0.04 −0.05 +0.00 −0.05 +0.01 −0.01]
State 158, Action S, Q-values: [+0.05 −0.05 +0.00 −0.05 +0.01 −0.02]
State 159, Action S, Q-values: [+0.05 −0.05 −0.00 −0.05 +0.02 −0.02]
State 160, Action S, Q-values: [+0.04 −0.05 +0.00 −0.05 +0.01 −0.01]
State 161, Action S, Q-values: [+0.05 −0.05 −0.00 −0.05 +0.02 −0.01]
State 162, Action S, Q-values: [+0.04 −0.05 +0.00 −0.05 +0.02 −0.01]
State 163, Action S, Q-values: [+0.05 −0.05 −0.00 −0.06 +0.01 −0.02]
State 164, Action S, Q-values: [+0.04 −0.05 −0.00 −0.05 +0.01 −0.02]
State 165, Action S, Q-values: [+0.04 −0.05 −0.00 −0.05 +0.02 −0.01]
State 166, Action S, Q-values: [+0.04 −0.05 +0.00 −0.05 +0.02 −0.02]
State 167, Action S, Q-values: [+0.04 −0.05 −0.01 −0.05 +0.01 −0.01]
State 168, Action S, Q-values: [+0.05 −0.05 +0.00 −0.04 +0.01 −0.02]
State 169, Action S, Q-values: [+0.04 −0.05 −0.00 −0.05 +0.01 −0.01]
State 170, Action S, Q-values: [+0.04 −0.05 −0.01 −0.05 +0.02 −0.02]
State 171, Action S, Q-values: [+0.04 −0.05 +0.00 −0.05 +0.01 −0.01]
State 172, Action S, Q-values: [+0.05 −0.06 −0.00 −0.05 +0.01 −0.01]
State 173, Action S, Q-values: [+0.05 −0.05 +0.00 −0.05 +0.02 −0.01]
State 174, Action S, Q-values: [+0.04 −0.04 +0.00 −0.05 +0.01 −0.02]
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State 175, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.02 -0.01]
State 176, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 177, Action S, Q-values: [+0.04 -0.04 +0.01 -0.04 +0.01 -0.02]
State 178, Action S, Q-values: [+0.04 -0.05 -0.01 -0.06 +0.02 -0.01]
State 179, Action S, Q-values: [+0.04 -0.05 -0.01 -0.06 +0.01 -0.01]
State 180, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.01]
State 181, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 182, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.02 -0.01]
State 183, Action S, Q-values: [+0.04 -0.04 -0.00 -0.05 +0.02 -0.02]
State 184, Action S, Q-values: [+0.04 -0.04 +0.00 -0.06 +0.02 -0.02]
State 185, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.01]
State 186, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.01]
State 187, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.02]
State 188, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.01]
State 189, Action S, Q-values: [+0.04 -0.05 -0.01 -0.06 +0.02 -0.01]
State 190, Action S, Q-values: [+0.04 -0.05 -0.01 -0.06 +0.01 -0.01]
State 191, Action S, Q-values: [+0.05 -0.05 +0.01 -0.05 +0.01 -0.02]
State 192, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.01 -0.01]
State 193, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.01 -0.02]
State 194, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.01 -0.01]
State 195, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.00 -0.02]
State 196, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.02]
State 197, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.01 -0.01]
State 198, Action S, Q-values: [+0.05 -0.05 -0.01 -0.05 +0.01 -0.01]
State 199, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 200, Action S, Q-values: [+0.04 -0.04 -0.00 -0.05 +0.02 -0.01]
State 201, Action S, Q-values: [+0.05 -0.05 -0.01 -0.06 +0.01 -0.01]
State 202, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 203, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.02]
State 204, Action S, Q-values: [+0.05 -0.05 -0.01 -0.05 +0.02 -0.01]
State 205, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.02]
State 206, Action S, Q-values: [+0.05 -0.05 -0.01 -0.06 +0.02 -0.02]
State 207, Action S, Q-values: [+0.05 -0.05 -0.01 -0.05 +0.02 -0.01]
State 208, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 209, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.01]
State 210, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.02 -0.01]
State 211, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 212, Action S, Q-values: [+0.05 -0.06 -0.01 -0.05 +0.01 -0.02]
State 213, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.02]
State 214, Action S, Q-values: [+0.04 -0.04 -0.01 -0.05 +0.02 -0.01]
State 215, Action S, Q-values: [+0.05 -0.05 +0.00 -0.06 +0.02 -0.02]
State 216, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.02 -0.02]
State 217, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.02 -0.01]
State 218, Action S, Q-values: [+0.05 -0.05 -0.01 -0.06 +0.01 -0.01]
State 219, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 220, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 221, Action S, Q-values: [+0.05 -0.05 -0.01 -0.06 +0.02 -0.02]
State 222, Action S, Q-values: [+0.04 -0.04 +0.00 -0.05 +0.01 -0.02]
State 223, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.02 -0.02]
State 224, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.02 -0.01]
State 225, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.02 -0.02]
State 226, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.02 -0.01]
State 227, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 228, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 229, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.02]
State 230, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.01 -0.01]
State 231, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.02 -0.01]
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State 232, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.01]
State 233, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.01 -0.01]
State 234, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.01]
State 235, Action S, Q-values: [+0.05 -0.05 -0.01 -0.06 +0.02 -0.01]
State 236, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 237, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.01 -0.02]
State 238, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.02]
State 239, Action S, Q-values: [+0.04 -0.06 -0.01 -0.06 +0.02 -0.01]
State 240, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.01 -0.01]
State 241, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.01]
State 242, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.01 -0.01]
State 243, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.02 -0.01]
State 244, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 245, Action S, Q-values: [+0.05 -0.05 -0.01 -0.05 +0.01 -0.02]
State 246, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.02]
State 247, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.01]
State 248, Action S, Q-values: [+0.05 -0.05 -0.01 -0.06 +0.02 -0.01]
State 249, Action S, Q-values: [+0.05 -0.05 -0.01 -0.06 +0.02 -0.02]
State 250, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.02 -0.01]
State 251, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.02]
State 252, Action S, Q-values: [+0.04 -0.04 -0.01 -0.05 +0.01 -0.01]
State 253, Action S, Q-values: [+0.04 -0.05 -0.01 -0.06 +0.02 -0.01]
State 254, Action S, Q-values: [+0.05 -0.05 +0.00 -0.06 +0.01 -0.01]
State 255, Action S, Q-values: [+0.04 -0.04 -0.00 -0.06 +0.02 -0.02]
State 256, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.02 -0.01]
State 257, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.01]
State 258, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.01]
State 259, Action S, Q-values: [+0.05 -0.06 -0.00 -0.06 +0.01 -0.01]
State 260, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 261, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 262, Action S, Q-values: [+0.05 -0.05 +0.01 -0.06 +0.01 -0.02]
State 263, Action S, Q-values: [+0.04 -0.05 -0.01 -0.06 +0.02 -0.01]
State 264, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.02 -0.01]
State 265, Action S, Q-values: [+0.04 -0.05 -0.00 -0.04 +0.02 -0.02]
State 266, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.02]
State 267, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.01 -0.02]
State 268, Action S, Q-values: [+0.05 -0.05 -0.01 -0.05 +0.02 -0.01]
State 269, Action S, Q-values: [+0.05 -0.05 -0.01 -0.05 +0.01 -0.01]
State 270, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.02]
State 271, Action S, Q-values: [+0.04 -0.05 -0.01 -0.06 +0.02 -0.02]
State 272, Action S, Q-values: [+0.05 -0.05 -0.01 -0.05 +0.01 -0.01]
State 273, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.02 -0.02]
State 274, Action S, Q-values: [+0.04 -0.04 -0.00 -0.06 +0.02 -0.01]
State 275, Action S, Q-values: [+0.04 -0.05 -0.01 -0.06 +0.02 -0.02]
State 276, Action S, Q-values: [+0.05 -0.05 +0.00 -0.06 +0.01 -0.01]
State 277, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.01 -0.02]
State 278, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 279, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.02 -0.01]
State 280, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 281, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 282, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.02]
State 283, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.02 -0.02]
State 284, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.02 -0.01]
State 285, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.02]
State 286, Action S, Q-values: [+0.05 -0.05 -0.01 -0.06 +0.02 -0.01]
State 287, Action S, Q-values: [+0.04 -0.04 +0.00 -0.06 +0.02 -0.02]
State 288, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.01 -0.01]
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State 289, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.01]
State 290, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.02]
State 291, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 292, Action S, Q-values: [+0.04 -0.04 +0.00 -0.05 +0.02 -0.02]
State 293, Action S, Q-values: [+0.04 -0.06 -0.01 -0.06 +0.02 -0.01]
State 294, Action S, Q-values: [+0.04 -0.04 +0.00 -0.06 +0.02 -0.02]
State 295, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.02 -0.01]
State 296, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.02]
State 297, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 298, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.02 -0.01]
State 299, Action S, Q-values: [+0.04 -0.04 -0.00 -0.05 +0.01 -0.01]
State 300, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.01 -0.02]
State 301, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.02]
State 302, Action S, Q-values: [+0.04 -0.04 +0.01 -0.05 +0.01 -0.02]
State 303, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.02]
State 304, Action S, Q-values: [+0.04 -0.04 +0.00 -0.05 +0.02 -0.02]
State 305, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 306, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.02 -0.02]
State 307, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.01 -0.02]
State 308, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.02 -0.02]
State 309, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.02 -0.01]
State 310, Action S, Q-values: [+0.05 -0.04 -0.01 -0.05 +0.01 -0.01]
State 311, Action S, Q-values: [+0.04 -0.04 -0.00 -0.06 +0.01 -0.02]
State 312, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 313, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.02 -0.02]
State 314, Action S, Q-values: [+0.05 -0.04 +0.00 -0.05 +0.02 -0.01]
State 315, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.02 -0.02]
State 316, Action S, Q-values: [+0.04 -0.05 +0.00 -0.06 +0.02 -0.02]
State 317, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 318, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 319, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.02 -0.02]
State 320, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.01]
State 321, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.01]
State 322, Action S, Q-values: [+0.05 -0.05 -0.01 -0.06 +0.02 -0.00]
State 323, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.01 -0.01]
State 324, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.01 -0.01]
State 325, Action S, Q-values: [+0.04 -0.04 -0.00 -0.05 +0.02 -0.01]
State 326, Action S, Q-values: [+0.04 -0.04 +0.01 -0.05 +0.01 -0.02]
State 327, Action S, Q-values: [+0.04 -0.05 -0.00 -0.04 +0.01 -0.02]
State 328, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.01 -0.01]
State 329, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.01 -0.02]
State 330, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.02]
State 331, Action S, Q-values: [+0.04 -0.04 +0.00 -0.05 +0.02 -0.02]
State 332, Action S, Q-values: [+0.04 -0.04 -0.00 -0.05 +0.01 -0.01]
State 333, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.01]
State 334, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 335, Action S, Q-values: [+0.05 -0.04 +0.00 -0.06 +0.01 -0.02]
State 336, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.02]
State 337, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.00 -0.02]
State 338, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.02 -0.01]
State 339, Action S, Q-values: [+0.05 -0.05 -0.01 -0.05 +0.02 -0.01]
State 340, Action S, Q-values: [+0.05 -0.05 -0.01 -0.05 +0.01 -0.02]
State 341, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.01]
State 342, Action S, Q-values: [+0.04 -0.05 -0.00 -0.04 +0.01 -0.02]
State 343, Action S, Q-values: [+0.04 -0.05 -0.00 -0.04 +0.01 -0.01]
State 344, Action S, Q-values: [+0.05 -0.05 -0.01 -0.05 +0.01 -0.01]
State 345, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.02]
```

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State 346, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.01 -0.02]
State 347, Action S, Q-values: [+0.04 -0.04 +0.00 -0.05 +0.02 -0.02]
State 348, Action S, Q-values: [+0.04 -0.04 +0.00 -0.05 +0.02 -0.01]
State 349, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.01]
State 350, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.02 -0.01]
State 351, Action S, Q-values: [+0.05 -0.05 +0.00 -0.06 +0.01 -0.01]
State 352, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.00 -0.02]
State 353, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.02]
State 354, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.01 -0.02]
State 355, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.01 -0.01]
State 356, Action S, Q-values: [+0.05 -0.05 -0.01 -0.05 +0.01 -0.01]
State 357, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.01 -0.01]
State 358, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.02 -0.02]
State 359, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.01 -0.02]
State 360, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 361, Action S, Q-values: [+0.04 -0.05 +0.01 -0.05 +0.01 -0.01]
State 362, Action S, Q-values: [+0.04 -0.04 +0.00 -0.05 +0.02 -0.02]
State 363, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.02 -0.02]
State 364, Action S, Q-values: [+0.04 -0.04 +0.00 -0.05 +0.01 -0.01]
State 365, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 366, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.01 -0.02]
State 367, Action S, Q-values: [+0.04 -0.05 -0.01 -0.06 +0.02 -0.02]
State 368, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.02]
State 369, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 370, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.01 -0.01]
State 371, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.02 -0.01]
State 372, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.02]
State 373, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.02 -0.02]
State 374, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.01]
State 375, Action S, Q-values: [+0.04 -0.04 -0.01 -0.06 +0.02 -0.02]
State 376, Action S, Q-values: [+0.04 -0.04 +0.00 -0.05 +0.02 -0.02]
State 377, Action S, Q-values: [+0.05 -0.06 -0.00 -0.06 +0.02 -0.01]
State 378, Action S, Q-values: [+0.04 -0.05 +0.01 -0.06 +0.02 -0.01]
State 379, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.02]
State 380, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.02 -0.02]
State 381, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.01 -0.01]
State 382, Action S, Q-values: [+0.05 -0.05 +0.00 -0.06 +0.01 -0.02]
State 383, Action S, Q-values: [+0.04 -0.05 -0.01 -0.06 +0.03 -0.02]
State 384, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 385, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.01 -0.02]
State 386, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 387, Action S, Q-values: [+0.04 -0.04 -0.01 -0.05 +0.01 -0.02]
State 388, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 389, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.02]
State 390, Action S, Q-values: [+0.04 -0.05 +0.01 -0.05 +0.01 -0.01]
State 391, Action S, Q-values: [+0.05 -0.05 -0.01 -0.05 +0.01 -0.01]
State 392, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.01 -0.02]
State 393, Action S, Q-values: [+0.03 -0.05 -0.00 -0.05 +0.02 -0.01]
State 394, Action S, Q-values: [+0.04 -0.05 -0.01 -0.04 +0.01 -0.02]
State 395, Action S, Q-values: [+0.04 -0.04 -0.00 -0.05 +0.02 -0.02]
State 396, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.02]
State 397, Action S, Q-values: [+0.04 -0.05 -0.01 -0.06 +0.01 -0.01]
State 398, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.01 -0.02]
State 399, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.01]
State 400, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 401, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.01 -0.01]
State 402, Action S, Q-values: [+0.04 -0.04 -0.00 -0.05 +0.01 -0.02]
```

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State 403, Action S, Q-values: [+0.04 -0.04 -0.00 -0.06 +0.01 -0.01]
State 404, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.02]
State 405, Action S, Q-values: [+0.04 -0.04 +0.01 -0.04 +0.01 -0.02]
State 406, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 407, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.01]
State 408, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.01 -0.01]
State 409, Action S, Q-values: [+0.04 -0.04 -0.00 -0.06 +0.01 -0.02]
State 410, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.02 -0.02]
State 411, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 412, Action S, Q-values: [+0.04 -0.04 -0.00 -0.05 +0.02 -0.02]
State 413, Action S, Q-values: [+0.04 -0.05 +0.00 -0.06 +0.01 -0.02]
State 414, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 415, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.02 -0.02]
State 416, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 417, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.02]
State 418, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.01 -0.02]
State 419, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.01 -0.01]
State 420, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 421, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.02 -0.02]
State 422, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.01]
State 423, Action S, Q-values: [+0.05 -0.05 -0.01 -0.05 +0.00 -0.02]
State 424, Action S, Q-values: [+0.05 -0.05 -0.00 -0.06 +0.01 -0.01]
State 425, Action S, Q-values: [+0.05 -0.05 -0.01 -0.05 +0.01 -0.02]
State 426, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.02 -0.02]
State 427, Action S, Q-values: [+0.05 -0.05 -0.01 -0.06 +0.02 -0.01]
State 428, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.02]
State 429, Action S, Q-values: [+0.04 -0.05 +0.00 -0.06 +0.02 -0.02]
State 430, Action S, Q-values: [+0.05 -0.05 -0.01 -0.05 +0.01 -0.01]
State 431, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.01 -0.02]
State 432, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 433, Action S, Q-values: [+0.04 -0.05 +0.01 -0.05 +0.01 -0.02]
State 434, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.01 -0.01]
State 435, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 436, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.01]
State 437, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.02 -0.02]
State 438, Action S, Q-values: [+0.04 -0.04 +0.00 -0.06 +0.02 -0.02]
State 439, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.02]
State 440, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.01 -0.01]
State 441, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.02 -0.01]
State 442, Action S, Q-values: [+0.05 -0.05 +0.00 -0.06 +0.02 -0.01]
State 443, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.02]
State 444, Action S, Q-values: [+0.05 -0.04 -0.00 -0.05 +0.02 -0.01]
State 445, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.02 -0.02]
State 446, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.01 -0.02]
State 447, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 448, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.01 -0.02]
State 449, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 450, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 451, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.00 -0.02]
State 452, Action S, Q-values: [+0.04 -0.04 -0.01 -0.05 +0.01 -0.02]
State 453, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.02]
State 454, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.02 -0.02]
State 455, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.02 -0.01]
State 456, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.02 -0.01]
State 457, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.01]
State 458, Action S, Q-values: [+0.04 -0.06 -0.00 -0.06 +0.01 -0.02]
State 459, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.02]
```

```
State 460, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.01 -0.01]
State 461, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.02 -0.01]
State 462, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.01 -0.02]
State 463, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.02]
State 464, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 465, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.02]
State 466, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.02 -0.02]
State 467, Action S, Q-values: [+0.05 -0.05 -0.01 -0.06 +0.02 -0.01]
State 468, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.01 -0.02]
State 469, Action S, Q-values: [+0.04 -0.05 -0.01 -0.04 +0.01 -0.02]
State 470, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 471, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.02 -0.02]
State 472, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.01 -0.01]
State 473, Action S, Q-values: [+0.04 -0.05 +0.01 -0.05 +0.01 -0.01]
State 474, Action S, Q-values: [+0.04 -0.06 +0.01 -0.05 +0.02 -0.02]
State 475, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.02 -0.01]
State 476, Action S, Q-values: [+0.04 -0.04 -0.00 -0.05 +0.02 -0.02]
State 477, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.02 -0.01]
State 478, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 479, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.02]
State 480, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.02 -0.01]
State 481, Action S, Q-values: [+0.04 -0.06 -0.01 -0.06 +0.02 -0.01]
State 482, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.03 -0.01]
State 483, Action S, Q-values: [+0.04 -0.04 -0.00 -0.05 +0.01 -0.02]
State 484, Action S, Q-values: [+0.04 -0.05 +0.00 -0.04 +0.01 -0.02]
State 485, Action S, Q-values: [+0.04 -0.05 -0.00 -0.04 +0.00 -0.02]
State 486, Action S, Q-values: [+0.05 -0.05 +0.00 -0.05 +0.01 -0.01]
State 487, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.02 -0.02]
State 488, Action S, Q-values: [+0.04 -0.05 -0.00 -0.06 +0.02 -0.02]
State 489, Action S, Q-values: [+0.04 -0.04 +0.00 -0.06 +0.01 -0.02]
State 490, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.01 -0.02]
State 491, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.02 -0.02]
State 492, Action S, Q-values: [+0.05 -0.05 -0.00 -0.05 +0.01 -0.01]
State 493, Action S, Q-values: [+0.04 -0.05 +0.00 -0.05 +0.02 -0.01]
State 494, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.01]
State 495, Action S, Q-values: [+0.04 -0.04 -0.01 -0.05 +0.01 -0.01]
State 496, Action S, Q-values: [+0.05 -0.05 -0.01 -0.05 +0.02 -0.01]
State 497, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 498, Action S, Q-values: [+0.04 -0.05 -0.00 -0.05 +0.01 -0.02]
State 499, Action S, Q-values: [+0.04 -0.05 -0.01 -0.05 +0.01 -0.01]
Episode 100/100000, Avg Reward: -770.15, Epsilon: 0.99
Episode 200/100000, Avg Reward: -758.26, Epsilon: 0.99
Episode 300/100000, Avg Reward: -765.44, Epsilon: 0.98
Episode 400/100000, Avg Reward: -759.92, Epsilon: 0.97
Episode 500/100000, Avg Reward: -756.13, Epsilon: 0.97
Episode 600/100000, Avg Reward: -756.59, Epsilon: 0.96
Episode 700/100000, Avg Reward: -742.80, Epsilon: 0.95
Episode 800/100000, Avg Reward: -730.48, Epsilon: 0.95
Episode 900/100000, Avg Reward: -740.86, Epsilon: 0.94
Episode 1000/100000, Avg Reward: -721.52, Epsilon: 0.93
Episode 1100/100000, Avg Reward: -718.38, Epsilon: 0.93
Episode 1200/100000, Avg Reward: -723.38, Epsilon: 0.92
Episode 1300/100000, Avg Reward: -702.11, Epsilon: 0.91
Episode 1400/100000, Avg Reward: -713.38, Epsilon: 0.91
Episode 1500/100000, Avg Reward: -728.45, Epsilon: 0.90
Episode 1600/100000, Avg Reward: -705.45, Epsilon: 0.90
Episode 1700/100000, Avg Reward: -710.29, Epsilon: 0.89
```

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Episode 1800/100000, Avg Reward: -700.93, Epsilon: 0.88
Episode 1900/100000, Avg Reward: -702.44, Epsilon: 0.88
Episode 2000/100000, Avg Reward: -713.11, Epsilon: 0.87
Episode 2100/100000, Avg Reward: -698.30, Epsilon: 0.86
Episode 2200/100000, Avg Reward: -666.94, Epsilon: 0.86
Episode 2300/100000, Avg Reward: -679.92, Epsilon: 0.85
Episode 2400/100000, Avg Reward: -664.92, Epsilon: 0.85
Episode 2500/100000, Avg Reward: -656.73, Epsilon: 0.84
Episode 2600/100000, Avg Reward: -673.05, Epsilon: 0.84
Episode 2700/100000, Avg Reward: -657.64, Epsilon: 0.83
Episode 2800/100000, Avg Reward: -642.35, Epsilon: 0.82
Episode 2900/100000, Avg Reward: -655.11, Epsilon: 0.82
Episode 3000/100000, Avg Reward: -652.69, Epsilon: 0.81
Episode 3100/100000, Avg Reward: -641.01, Epsilon: 0.81
Episode 3200/100000, Avg Reward: -632.39, Epsilon: 0.80
Episode 3300/100000, Avg Reward: -636.16, Epsilon: 0.80
Episode 3400/100000, Avg Reward: -626.20, Epsilon: 0.79
Episode 3500/100000, Avg Reward: -624.74, Epsilon: 0.79
Episode 3600/100000, Avg Reward: -597.62, Epsilon: 0.78
Episode 3700/100000, Avg Reward: -604.64, Epsilon: 0.77
Episode 3800/100000, Avg Reward: -590.18, Epsilon: 0.77
Episode 3900/100000, Avg Reward: -573.02, Epsilon: 0.76
Episode 4000/100000, Avg Reward: -577.31, Epsilon: 0.76
Episode 4100/100000, Avg Reward: -559.28, Epsilon: 0.75
Episode 4200/100000, Avg Reward: -582.16, Epsilon: 0.75
Episode 4300/100000, Avg Reward: -570.16, Epsilon: 0.74
Episode 4400/100000, Avg Reward: -547.23, Epsilon: 0.74
Episode 4500/100000, Avg Reward: -561.61, Epsilon: 0.73
Episode 4600/100000, Avg Reward: -542.31, Epsilon: 0.73
Episode 4700/100000, Avg Reward: -571.20, Epsilon: 0.72
Episode 4800/100000, Avg Reward: -525.34, Epsilon: 0.72
Episode 4900/100000, Avg Reward: -551.48, Epsilon: 0.71
Episode 5000/100000, Avg Reward: -550.47, Epsilon: 0.71
Episode 5100/100000, Avg Reward: -545.74, Epsilon: 0.70
Episode 5200/100000, Avg Reward: -518.82, Epsilon: 0.70
Episode 5300/100000, Avg Reward: -493.89, Epsilon: 0.69
Episode 5400/100000, Avg Reward: -507.11, Epsilon: 0.69
Episode 5500/100000, Avg Reward: -509.65, Epsilon: 0.68
Episode 5600/100000, Avg Reward: -472.15, Epsilon: 0.68
Episode 5700/100000, Avg Reward: -423.91, Epsilon: 0.67
Episode 5800/100000, Avg Reward: -421.03, Epsilon: 0.67
Episode 5900/100000, Avg Reward: -373.67, Epsilon: 0.67
Episode 6000/100000, Avg Reward: -376.60, Epsilon: 0.66
Episode 6100/100000, Avg Reward: -327.91, Epsilon: 0.66
Episode 6200/100000, Avg Reward: -236.56, Epsilon: 0.65
Episode 6300/100000, Avg Reward: -211.28, Epsilon: 0.65
Episode 6400/100000, Avg Reward: -214.58, Epsilon: 0.64
Episode 6500/100000, Avg Reward: -135.89, Epsilon: 0.64
Episode 6600/100000, Avg Reward: -114.42, Epsilon: 0.63
Episode 6700/100000, Avg Reward: -107.55, Epsilon: 0.63
Episode 6800/100000, Avg Reward: -90.20, Epsilon: 0.63
Episode 6900/100000, Avg Reward: -80.69, Epsilon: 0.62
Episode 7000/100000, Avg Reward: -100.17, Epsilon: 0.62
Episode 7100/100000, Avg Reward: -84.90, Epsilon: 0.61
Episode 7200/100000, Avg Reward: -82.52, Epsilon: 0.61
Episode 7300/100000, Avg Reward: -81.66, Epsilon: 0.60
Episode 7400/100000, Avg Reward: -80.94, Epsilon: 0.60
```

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Episode 7500/100000, Avg Reward: -78.02, Epsilon: 0.60
Episode 7600/100000, Avg Reward: -81.74, Epsilon: 0.59
Episode 7700/100000, Avg Reward: -74.59, Epsilon: 0.59
Episode 7800/100000, Avg Reward: -63.27, Epsilon: 0.58
Episode 7900/100000, Avg Reward: -75.62, Epsilon: 0.58
Episode 8000/100000, Avg Reward: -64.91, Epsilon: 0.58
Episode 8100/100000, Avg Reward: -75.36, Epsilon: 0.57
Episode 8200/100000, Avg Reward: -71.68, Epsilon: 0.57
Episode 8300/100000, Avg Reward: -71.35, Epsilon: 0.56
Episode 8400/100000, Avg Reward: -69.69, Epsilon: 0.56
Episode 8500/100000, Avg Reward: -58.82, Epsilon: 0.56
Episode 8600/100000, Avg Reward: -57.90, Epsilon: 0.55
Episode 8700/100000, Avg Reward: -65.24, Epsilon: 0.55
Episode 8800/100000, Avg Reward: -59.31, Epsilon: 0.54
Episode 8900/100000, Avg Reward: -61.80, Epsilon: 0.54
Episode 9000/100000, Avg Reward: -53.34, Epsilon: 0.54
Episode 9100/100000, Avg Reward: -62.47, Epsilon: 0.53
Episode 9200/100000, Avg Reward: -58.47, Epsilon: 0.53
Episode 9300/100000, Avg Reward: -57.62, Epsilon: 0.53
Episode 9400/100000, Avg Reward: -49.78, Epsilon: 0.52
Episode 9500/100000, Avg Reward: -49.74, Epsilon: 0.52
Episode 9600/100000, Avg Reward: -48.98, Epsilon: 0.52
Episode 9700/100000, Avg Reward: -48.74, Epsilon: 0.51
Episode 9800/100000, Avg Reward: -49.30, Epsilon: 0.51
Episode 9900/100000, Avg Reward: -52.59, Epsilon: 0.50
Episode 10000/100000, Avg Reward: -46.75, Epsilon: 0.50
Episode 10100/100000, Avg Reward: -48.38, Epsilon: 0.50
Episode 10200/100000, Avg Reward: -50.30, Epsilon: 0.49
Episode 10300/100000, Avg Reward: -48.42, Epsilon: 0.49
Episode 10400/100000, Avg Reward: -41.59, Epsilon: 0.49
Episode 10500/100000, Avg Reward: -45.12, Epsilon: 0.48
Episode 10600/100000, Avg Reward: -46.18, Epsilon: 0.48
Episode 10700/100000, Avg Reward: -45.37, Epsilon: 0.48
Episode 10800/100000, Avg Reward: -40.18, Epsilon: 0.47
Episode 10900/100000, Avg Reward: -43.66, Epsilon: 0.47
Episode 11000/100000, Avg Reward: -38.20, Epsilon: 0.47
Episode 11100/100000, Avg Reward: -38.95, Epsilon: 0.46
Episode 11200/100000, Avg Reward: -40.60, Epsilon: 0.46
Episode 11300/100000, Avg Reward: -36.68, Epsilon: 0.46
Episode 11400/100000, Avg Reward: -34.57, Epsilon: 0.45
Episode 11500/100000, Avg Reward: -32.23, Epsilon: 0.45
Episode 11600/100000, Avg Reward: -39.52, Epsilon: 0.45
Episode 11700/100000, Avg Reward: -39.96, Epsilon: 0.45
Episode 11800/100000, Avg Reward: -36.04, Epsilon: 0.44
Episode 11900/100000, Avg Reward: -34.57, Epsilon: 0.44
Episode 12000/100000, Avg Reward: -30.01, Epsilon: 0.44
Episode 12100/100000, Avg Reward: -32.95, Epsilon: 0.43
Episode 12200/100000, Avg Reward: -28.20, Epsilon: 0.43
Episode 12300/100000, Avg Reward: -32.66, Epsilon: 0.43
Episode 12400/100000, Avg Reward: -31.80, Epsilon: 0.42
Episode 12500/100000, Avg Reward: -26.84, Epsilon: 0.42
Episode 12600/100000, Avg Reward: -32.57, Epsilon: 0.42
Episode 12700/100000, Avg Reward: -24.33, Epsilon: 0.42
Episode 12800/100000, Avg Reward: -29.55, Epsilon: 0.41
Episode 12900/100000, Avg Reward: -31.16, Epsilon: 0.41
Episode 13000/100000, Avg Reward: -32.19, Epsilon: 0.41
Episode 13100/100000, Avg Reward: -28.44, Epsilon: 0.40
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Episode 13200/100000, Avg Reward: -30.14, Epsilon: 0.40
Episode 13300/100000, Avg Reward: -25.84, Epsilon: 0.40
Episode 13400/100000, Avg Reward: -25.36, Epsilon: 0.40
Episode 13500/100000, Avg Reward: -30.12, Epsilon: 0.39
Episode 13600/100000, Avg Reward: -30.67, Epsilon: 0.39
Episode 13700/100000, Avg Reward: -30.33, Epsilon: 0.39
Episode 13800/100000, Avg Reward: -23.47, Epsilon: 0.39
Episode 13900/100000, Avg Reward: -24.40, Epsilon: 0.38
Episode 14000/100000, Avg Reward: -25.13, Epsilon: 0.38
Episode 14100/100000, Avg Reward: -25.49, Epsilon: 0.38
Episode 14200/100000, Avg Reward: -23.59, Epsilon: 0.37
Episode 14300/100000, Avg Reward: -25.59, Epsilon: 0.37
Episode 14400/100000, Avg Reward: -25.15, Epsilon: 0.37
Episode 14500/100000, Avg Reward: -26.87, Epsilon: 0.37
Episode 14600/100000, Avg Reward: -23.53, Epsilon: 0.36
Episode 14700/100000, Avg Reward: -23.35, Epsilon: 0.36
Episode 14800/100000, Avg Reward: -22.56, Epsilon: 0.36
Episode 14900/100000, Avg Reward: -20.26, Epsilon: 0.36
Episode 15000/100000, Avg Reward: -19.65, Epsilon: 0.35
Episode 15100/100000, Avg Reward: -21.80, Epsilon: 0.35
Episode 15200/100000, Avg Reward: -19.37, Epsilon: 0.35
Episode 15300/100000, Avg Reward: -22.11, Epsilon: 0.35
Episode 15400/100000, Avg Reward: -20.81, Epsilon: 0.35
Episode 15500/100000, Avg Reward: -18.37, Epsilon: 0.34
Episode 15600/100000, Avg Reward: -19.75, Epsilon: 0.34
Episode 15700/100000, Avg Reward: -22.65, Epsilon: 0.34
Episode 15800/100000, Avg Reward: -20.02, Epsilon: 0.34
Episode 15900/100000, Avg Reward: -18.78, Epsilon: 0.33
Episode 16000/100000, Avg Reward: -17.41, Epsilon: 0.33
Episode 16100/100000, Avg Reward: -17.76, Epsilon: 0.33
Episode 16200/100000, Avg Reward: -21.26, Epsilon: 0.33
Episode 16300/100000, Avg Reward: -18.32, Epsilon: 0.32
Episode 16400/100000, Avg Reward: -20.27, Epsilon: 0.32
Episode 16500/100000, Avg Reward: -17.40, Epsilon: 0.32
Episode 16600/100000, Avg Reward: -16.30, Epsilon: 0.32
Episode 16700/100000, Avg Reward: -16.25, Epsilon: 0.32
Episode 16800/100000, Avg Reward: -14.29, Epsilon: 0.31
Episode 16900/100000, Avg Reward: -15.99, Epsilon: 0.31
Episode 17000/100000, Avg Reward: -17.56, Epsilon: 0.31
Episode 17100/100000, Avg Reward: -14.83, Epsilon: 0.31
Episode 17200/100000, Avg Reward: -14.13, Epsilon: 0.30
Episode 17300/100000, Avg Reward: -16.87, Epsilon: 0.30
Episode 17400/100000, Avg Reward: -13.69, Epsilon: 0.30
Episode 17500/100000, Avg Reward: -13.50, Epsilon: 0.30
Episode 17600/100000, Avg Reward: -14.99, Epsilon: 0.30
Episode 17700/100000, Avg Reward: -15.47, Epsilon: 0.29
Episode 17800/100000, Avg Reward: -13.55, Epsilon: 0.29
Episode 17900/100000, Avg Reward: -11.09, Epsilon: 0.29
Episode 18000/100000, Avg Reward: -13.74, Epsilon: 0.29
Episode 18100/100000, Avg Reward: -16.07, Epsilon: 0.29
Episode 18200/100000, Avg Reward: -14.69, Epsilon: 0.28
Episode 18300/100000, Avg Reward: -12.37, Epsilon: 0.28
Episode 18400/100000, Avg Reward: -12.87, Epsilon: 0.28
Episode 18500/100000, Avg Reward: -16.78, Epsilon: 0.28
Episode 18600/100000, Avg Reward: -11.99, Epsilon: 0.28
Episode 18700/100000, Avg Reward: -16.25, Epsilon: 0.27
Episode 18800/100000, Avg Reward: -13.60, Epsilon: 0.27
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Episode 18900/100000, Avg Reward: -10.25, Epsilon: 0.27
Episode 19000/100000, Avg Reward: -10.86, Epsilon: 0.27
Episode 19100/100000, Avg Reward: -10.80, Epsilon: 0.27
Episode 19200/100000, Avg Reward: -6.28, Epsilon: 0.27
Episode 19300/100000, Avg Reward: -9.97, Epsilon: 0.26
Episode 19400/100000, Avg Reward: -10.41, Epsilon: 0.26
Episode 19500/100000, Avg Reward: -9.42, Epsilon: 0.26
Episode 19600/100000, Avg Reward: -10.80, Epsilon: 0.26
Episode 19700/100000, Avg Reward: -10.75, Epsilon: 0.26
Episode 19800/100000, Avg Reward: -13.06, Epsilon: 0.25
Episode 19900/100000, Avg Reward: -9.38, Epsilon: 0.25
Episode 20000/100000, Avg Reward: -10.08, Epsilon: 0.25
Episode 20100/100000, Avg Reward: -12.49, Epsilon: 0.25
Episode 20200/100000, Avg Reward: -8.39, Epsilon: 0.25
Episode 20300/100000, Avg Reward: -7.02, Epsilon: 0.25
Episode 20400/100000, Avg Reward: -10.03, Epsilon: 0.24
Episode 20500/100000, Avg Reward: -9.46, Epsilon: 0.24
Episode 20600/100000, Avg Reward: -8.67, Epsilon: 0.24
Episode 20700/100000, Avg Reward: -8.82, Epsilon: 0.24
Episode 20800/100000, Avg Reward: -6.85, Epsilon: 0.24
Episode 20900/100000, Avg Reward: -9.45, Epsilon: 0.24
Episode 21000/100000, Avg Reward: -6.83, Epsilon: 0.23
Episode 21100/100000, Avg Reward: -7.48, Epsilon: 0.23
Episode 21200/100000, Avg Reward: -6.64, Epsilon: 0.23
Episode 21300/100000, Avg Reward: -8.58, Epsilon: 0.23
Episode 21400/100000, Avg Reward: -8.75, Epsilon: 0.23
Episode 21500/100000, Avg Reward: -10.69, Epsilon: 0.23
Episode 21600/100000, Avg Reward: -9.04, Epsilon: 0.22
Episode 21700/100000, Avg Reward: -5.85, Epsilon: 0.22
Episode 21800/100000, Avg Reward: -6.44, Epsilon: 0.22
Episode 21900/100000, Avg Reward: -6.02, Epsilon: 0.22
Episode 22000/100000, Avg Reward: -6.31, Epsilon: 0.22
Episode 22100/100000, Avg Reward: -8.37, Epsilon: 0.22
Episode 22200/100000, Avg Reward: -4.01, Epsilon: 0.22
Episode 22300/100000, Avg Reward: -6.75, Epsilon: 0.21
Episode 22400/100000, Avg Reward: -7.95, Epsilon: 0.21
Episode 22500/100000, Avg Reward: -3.67, Epsilon: 0.21
Episode 22600/100000, Avg Reward: -5.87, Epsilon: 0.21
Episode 22700/100000, Avg Reward: -5.46, Epsilon: 0.21
Episode 22800/100000, Avg Reward: -3.16, Epsilon: 0.21
Episode 22900/100000, Avg Reward: -5.38, Epsilon: 0.21
Episode 23000/100000, Avg Reward: -4.15, Epsilon: 0.20
Episode 23100/100000, Avg Reward: -6.32, Epsilon: 0.20
Episode 23200/100000, Avg Reward: -4.61, Epsilon: 0.20
Episode 23300/100000, Avg Reward: -4.03, Epsilon: 0.20
Episode 23400/100000, Avg Reward: -5.23, Epsilon: 0.20
Episode 23500/100000, Avg Reward: -5.00, Epsilon: 0.20
Episode 23600/100000, Avg Reward: -4.86, Epsilon: 0.20
Episode 23700/100000, Avg Reward: -3.70, Epsilon: 0.19
Episode 23800/100000, Avg Reward: -4.76, Epsilon: 0.19
Episode 23900/100000, Avg Reward: -3.96, Epsilon: 0.19
Episode 24000/100000, Avg Reward: -3.95, Epsilon: 0.19
Episode 24100/100000, Avg Reward: -6.06, Epsilon: 0.19
Episode 24200/100000, Avg Reward: -4.05, Epsilon: 0.19
Episode 24300/100000, Avg Reward: -3.35, Epsilon: 0.19
Episode 24400/100000, Avg Reward: -3.19, Epsilon: 0.19
Episode 24500/100000, Avg Reward: -1.93, Epsilon: 0.18
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Episode 24600/100000, Avg Reward: -3.53, Epsilon: 0.18
Episode 24700/100000, Avg Reward: -3.64, Epsilon: 0.18
Episode 24800/100000, Avg Reward: -2.91, Epsilon: 0.18
Episode 24900/100000, Avg Reward: -2.61, Epsilon: 0.18
Episode 25000/100000, Avg Reward: -3.57, Epsilon: 0.18
Episode 25100/100000, Avg Reward: -3.82, Epsilon: 0.18
Episode 25200/100000, Avg Reward: -4.93, Epsilon: 0.18
Episode 25300/100000, Avg Reward: -3.67, Epsilon: 0.17
Episode 25400/100000, Avg Reward: -2.49, Epsilon: 0.17
Episode 25500/100000, Avg Reward: -6.90, Epsilon: 0.17
Episode 25600/100000, Avg Reward: -0.91, Epsilon: 0.17
Episode 25700/100000, Avg Reward: -4.46, Epsilon: 0.17
Episode 25800/100000, Avg Reward: -3.51, Epsilon: 0.17
Episode 25900/100000, Avg Reward: -3.44, Epsilon: 0.17
Episode 26000/100000, Avg Reward: -1.74, Epsilon: 0.17
Episode 26100/100000, Avg Reward: -0.09, Epsilon: 0.16
Episode 26200/100000, Avg Reward: -2.07, Epsilon: 0.16
Episode 26300/100000, Avg Reward: -2.94, Epsilon: 0.16
Episode 26400/100000, Avg Reward: -2.40, Epsilon: 0.16
Episode 26500/100000, Avg Reward: -0.03, Epsilon: 0.16
Episode 26600/100000, Avg Reward: -1.73, Epsilon: 0.16
Episode 26700/100000, Avg Reward: -1.80, Epsilon: 0.16
Episode 26800/100000, Avg Reward: -0.61, Epsilon: 0.16
Episode 26900/100000, Avg Reward: -1.81, Epsilon: 0.16
Episode 27000/100000, Avg Reward: -1.27, Epsilon: 0.15
Episode 27100/100000, Avg Reward: -1.53, Epsilon: 0.15
Episode 27200/100000, Avg Reward: -0.16, Epsilon: 0.15
Episode 27300/100000, Avg Reward: 0.33, Epsilon: 0.15
Episode 27400/100000, Avg Reward: -3.12, Epsilon: 0.15
Episode 27500/100000, Avg Reward: -0.03, Epsilon: 0.15
Episode 27600/100000, Avg Reward: -0.66, Epsilon: 0.15
Episode 27700/100000, Avg Reward: -3.78, Epsilon: 0.15
Episode 27800/100000, Avg Reward: -1.83, Epsilon: 0.15
Episode 27900/100000, Avg Reward: -3.14, Epsilon: 0.15
Episode 28000/100000, Avg Reward: -1.81, Epsilon: 0.14
Episode 28100/100000, Avg Reward: 1.71, Epsilon: 0.14
Episode 28200/100000, Avg Reward: -0.24, Epsilon: 0.14
Episode 28300/100000, Avg Reward: -0.07, Epsilon: 0.14
Episode 28400/100000, Avg Reward: -1.14, Epsilon: 0.14
Episode 28500/100000, Avg Reward: 0.55, Epsilon: 0.14
Episode 28600/100000, Avg Reward: -2.35, Epsilon: 0.14
Episode 28700/100000, Avg Reward: 0.20, Epsilon: 0.14
Episode 28800/100000, Avg Reward: -2.19, Epsilon: 0.14
Episode 28900/100000, Avg Reward: 1.05, Epsilon: 0.14
Episode 29000/100000, Avg Reward: -0.01, Epsilon: 0.13
Episode 29100/100000, Avg Reward: 0.26, Epsilon: 0.13
Episode 29200/100000, Avg Reward: 0.41, Epsilon: 0.13
Episode 29300/100000, Avg Reward: -0.04, Epsilon: 0.13
Episode 29400/100000, Avg Reward: -0.52, Epsilon: 0.13
Episode 29500/100000, Avg Reward: 0.38, Epsilon: 0.13
Episode 29600/100000, Avg Reward: -0.28, Epsilon: 0.13
Episode 29700/100000, Avg Reward: 1.76, Epsilon: 0.13
Episode 29800/100000, Avg Reward: -0.41, Epsilon: 0.13
Episode 29900/100000, Avg Reward: 0.49, Epsilon: 0.13
Episode 30000/100000, Avg Reward: -0.53, Epsilon: 0.13
Episode 30100/100000, Avg Reward: 1.93, Epsilon: 0.13
Episode 30200/100000, Avg Reward: 2.23, Epsilon: 0.12
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Episode 30300/100000, Avg Reward: 2.87, Epsilon: 0.12
Episode 30400/100000, Avg Reward: 0.54, Epsilon: 0.12
Episode 30500/100000, Avg Reward: 0.92, Epsilon: 0.12
Episode 30600/100000, Avg Reward: -0.53, Epsilon: 0.12
Episode 30700/100000, Avg Reward: 1.35, Epsilon: 0.12
Episode 30800/100000, Avg Reward: 1.67, Epsilon: 0.12
Episode 30900/100000, Avg Reward: -0.95, Epsilon: 0.12
Episode 31000/100000, Avg Reward: 2.67, Epsilon: 0.12
Episode 31100/100000, Avg Reward: 0.02, Epsilon: 0.12
Episode 31200/100000, Avg Reward: 0.47, Epsilon: 0.12
Episode 31300/100000, Avg Reward: 2.11, Epsilon: 0.12
Episode 31400/100000, Avg Reward: 0.64, Epsilon: 0.11
Episode 31500/100000, Avg Reward: 1.50, Epsilon: 0.11
Episode 31600/100000, Avg Reward: -0.62, Epsilon: 0.11
Episode 31700/100000, Avg Reward: 2.59, Epsilon: 0.11
Episode 31800/100000, Avg Reward: 0.91, Epsilon: 0.11
Episode 31900/100000, Avg Reward: 1.47, Epsilon: 0.11
Episode 32000/100000, Avg Reward: -0.84, Epsilon: 0.11
Episode 32100/100000, Avg Reward: 1.69, Epsilon: 0.11
Episode 32200/100000, Avg Reward: 1.99, Epsilon: 0.11
Episode 32300/100000, Avg Reward: -0.47, Epsilon: 0.11
Episode 32400/100000, Avg Reward: 1.21, Epsilon: 0.11
Episode 32500/100000, Avg Reward: 1.05, Epsilon: 0.11
Episode 32600/100000, Avg Reward: 2.18, Epsilon: 0.11
Episode 32700/100000, Avg Reward: 2.54, Epsilon: 0.10
Episode 32800/100000, Avg Reward: 2.75, Epsilon: 0.10
Episode 32900/100000, Avg Reward: 1.29, Epsilon: 0.10
Episode 33000/100000, Avg Reward: 1.42, Epsilon: 0.10
Episode 33100/100000, Avg Reward: 2.94, Epsilon: 0.10
Episode 33200/100000, Avg Reward: 2.26, Epsilon: 0.10
Episode 33300/100000, Avg Reward: 2.98, Epsilon: 0.10
Episode 33400/100000, Avg Reward: 2.63, Epsilon: 0.10
Episode 33500/100000, Avg Reward: 2.28, Epsilon: 0.10
Episode 33600/100000, Avg Reward: 2.13, Epsilon: 0.10
Episode 33700/100000, Avg Reward: 1.57, Epsilon: 0.10
Episode 33800/100000, Avg Reward: 2.17, Epsilon: 0.10
Episode 33900/100000, Avg Reward: 2.98, Epsilon: 0.10
Episode 34000/100000, Avg Reward: 2.94, Epsilon: 0.10
Episode 34100/100000, Avg Reward: 3.02, Epsilon: 0.09
Episode 34200/100000, Avg Reward: 3.94, Epsilon: 0.09
Episode 34300/100000, Avg Reward: 3.11, Epsilon: 0.09
Episode 34400/100000, Avg Reward: 3.61, Epsilon: 0.09
Episode 34500/100000, Avg Reward: 2.62, Epsilon: 0.09
Episode 34600/100000, Avg Reward: 4.22, Epsilon: 0.09
Episode 34700/100000, Avg Reward: 2.28, Epsilon: 0.09
Episode 34800/100000, Avg Reward: 2.45, Epsilon: 0.09
Episode 34900/100000, Avg Reward: 2.72, Epsilon: 0.09
Episode 35000/100000, Avg Reward: 2.85, Epsilon: 0.09
Episode 35100/100000, Avg Reward: 0.11, Epsilon: 0.09
Episode 35200/100000, Avg Reward: 2.37, Epsilon: 0.09
Episode 35300/100000, Avg Reward: 4.34, Epsilon: 0.09
Episode 35400/100000, Avg Reward: 2.58, Epsilon: 0.09
Episode 35500/100000, Avg Reward: 4.37, Epsilon: 0.09
Episode 35600/100000, Avg Reward: 4.34, Epsilon: 0.09
Episode 35700/100000, Avg Reward: 2.87, Epsilon: 0.08
Episode 35800/100000, Avg Reward: 2.38, Epsilon: 0.08
Episode 35900/100000, Avg Reward: 3.21, Epsilon: 0.08
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Episode 36000/100000, Avg Reward: 0.54, Epsilon: 0.08
Episode 36100/100000, Avg Reward: 2.11, Epsilon: 0.08
Episode 36200/100000, Avg Reward: 3.22, Epsilon: 0.08
Episode 36300/100000, Avg Reward: 4.23, Epsilon: 0.08
Episode 36400/100000, Avg Reward: 3.07, Epsilon: 0.08
Episode 36500/100000, Avg Reward: 1.33, Epsilon: 0.08
Episode 36600/100000, Avg Reward: 2.39, Epsilon: 0.08
Episode 36700/100000, Avg Reward: 3.94, Epsilon: 0.08
Episode 36800/100000, Avg Reward: 4.33, Epsilon: 0.08
Episode 36900/100000, Avg Reward: 2.90, Epsilon: 0.08
Episode 37000/100000, Avg Reward: 5.29, Epsilon: 0.08
Episode 37100/100000, Avg Reward: 4.18, Epsilon: 0.08
Episode 37200/100000, Avg Reward: 4.60, Epsilon: 0.08
Episode 37300/100000, Avg Reward: 3.35, Epsilon: 0.08
Episode 37400/100000, Avg Reward: 4.14, Epsilon: 0.08
Episode 37500/100000, Avg Reward: 3.45, Epsilon: 0.07
Episode 37600/100000, Avg Reward: 4.48, Epsilon: 0.07
Episode 37700/100000, Avg Reward: 3.37, Epsilon: 0.07
Episode 37800/100000, Avg Reward: 3.58, Epsilon: 0.07
Episode 37900/100000, Avg Reward: 2.62, Epsilon: 0.07
Episode 38000/100000, Avg Reward: 4.47, Epsilon: 0.07
Episode 38100/100000, Avg Reward: 2.53, Epsilon: 0.07
Episode 38200/100000, Avg Reward: 5.45, Epsilon: 0.07
Episode 38300/100000, Avg Reward: -1.69, Epsilon: 0.07
Episode 38400/100000, Avg Reward: 3.09, Epsilon: 0.07
Episode 38500/100000, Avg Reward: 2.53, Epsilon: 0.07
Episode 38600/100000, Avg Reward: 3.36, Epsilon: 0.07
Episode 38700/100000, Avg Reward: 4.24, Epsilon: 0.07
Episode 38800/100000, Avg Reward: 4.99, Epsilon: 0.07
Episode 38900/100000, Avg Reward: 3.19, Epsilon: 0.07
Episode 39000/100000, Avg Reward: 4.71, Epsilon: 0.07
Episode 39100/100000, Avg Reward: 3.06, Epsilon: 0.07
Episode 39200/100000, Avg Reward: 4.29, Epsilon: 0.07
Episode 39300/100000, Avg Reward: 4.89, Epsilon: 0.07
Episode 39400/100000, Avg Reward: 4.22, Epsilon: 0.07
Episode 39500/100000, Avg Reward: 5.09, Epsilon: 0.07
Episode 39600/100000, Avg Reward: 4.98, Epsilon: 0.06
Episode 39700/100000, Avg Reward: 4.15, Epsilon: 0.06
Episode 39800/100000, Avg Reward: 4.72, Epsilon: 0.06
Episode 39900/100000, Avg Reward: 3.22, Epsilon: 0.06
Episode 40000/100000, Avg Reward: 5.07, Epsilon: 0.06
Episode 40100/100000, Avg Reward: 4.91, Epsilon: 0.06
Episode 40200/100000, Avg Reward: 2.81, Epsilon: 0.06
Episode 40300/100000, Avg Reward: 4.55, Epsilon: 0.06
Episode 40400/100000, Avg Reward: 5.24, Epsilon: 0.06
Episode 40500/100000, Avg Reward: 3.95, Epsilon: 0.06
Episode 40600/100000, Avg Reward: 5.07, Epsilon: 0.06
Episode 40700/100000, Avg Reward: 1.42, Epsilon: 0.06
Episode 40800/100000, Avg Reward: 4.73, Epsilon: 0.06
Episode 40900/100000, Avg Reward: 4.69, Epsilon: 0.06
Episode 41000/100000, Avg Reward: 5.00, Epsilon: 0.06
Episode 41100/100000, Avg Reward: 3.59, Epsilon: 0.06
Episode 41200/100000, Avg Reward: 4.37, Epsilon: 0.06
Episode 41300/100000, Avg Reward: 4.86, Epsilon: 0.06
Episode 41400/100000, Avg Reward: 4.87, Epsilon: 0.06
Episode 41500/100000, Avg Reward: 4.31, Epsilon: 0.06
Episode 41600/100000, Avg Reward: 4.60, Epsilon: 0.06
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Episode 41700/100000, Avg Reward: 5.38, Epsilon: 0.06
Episode 41800/100000, Avg Reward: 5.14, Epsilon: 0.06
Episode 41900/100000, Avg Reward: 3.72, Epsilon: 0.06
Episode 42000/100000, Avg Reward: 5.15, Epsilon: 0.05
Episode 42100/100000, Avg Reward: 2.16, Epsilon: 0.05
Episode 42200/100000, Avg Reward: 4.60, Epsilon: 0.05
Episode 42300/100000, Avg Reward: 5.31, Epsilon: 0.05
Episode 42400/100000, Avg Reward: 5.81, Epsilon: 0.05
Episode 42500/100000, Avg Reward: 5.48, Epsilon: 0.05
Episode 42600/100000, Avg Reward: 5.90, Epsilon: 0.05
Episode 42700/100000, Avg Reward: 5.53, Epsilon: 0.05
Episode 42800/100000, Avg Reward: 4.50, Epsilon: 0.05
Episode 42900/100000, Avg Reward: 3.93, Epsilon: 0.05
Episode 43000/100000, Avg Reward: 5.19, Epsilon: 0.05
Episode 43100/100000, Avg Reward: 2.73, Epsilon: 0.05
Episode 43200/100000, Avg Reward: 5.18, Epsilon: 0.05
Episode 43300/100000, Avg Reward: 3.11, Epsilon: 0.05
Episode 43400/100000, Avg Reward: 5.43, Epsilon: 0.05
Episode 43500/100000, Avg Reward: 5.94, Epsilon: 0.05
Episode 43600/100000, Avg Reward: 4.32, Epsilon: 0.05
Episode 43700/100000, Avg Reward: 5.99, Epsilon: 0.05
Episode 43800/100000, Avg Reward: 4.35, Epsilon: 0.05
Episode 43900/100000, Avg Reward: 6.42, Epsilon: 0.05
Episode 44000/100000, Avg Reward: 4.77, Epsilon: 0.05
Episode 44100/100000, Avg Reward: 5.88, Epsilon: 0.05
Episode 44200/100000, Avg Reward: 4.91, Epsilon: 0.05
Episode 44300/100000, Avg Reward: 3.96, Epsilon: 0.05
Episode 44400/100000, Avg Reward: 6.31, Epsilon: 0.05
Episode 44500/100000, Avg Reward: 5.50, Epsilon: 0.05
Episode 44600/100000, Avg Reward: 4.67, Epsilon: 0.05
Episode 44700/100000, Avg Reward: 4.65, Epsilon: 0.05
Episode 44800/100000, Avg Reward: 5.75, Epsilon: 0.05
Episode 44900/100000, Avg Reward: 0.94, Epsilon: 0.04
Episode 45000/100000, Avg Reward: 6.09, Epsilon: 0.04
Episode 45100/100000, Avg Reward: 5.54, Epsilon: 0.04
Episode 45200/100000, Avg Reward: 5.41, Epsilon: 0.04
Episode 45300/100000, Avg Reward: 5.03, Epsilon: 0.04
Episode 45400/100000, Avg Reward: 6.32, Epsilon: 0.04
Episode 45500/100000, Avg Reward: 5.54, Epsilon: 0.04
Episode 45600/100000, Avg Reward: 4.89, Epsilon: 0.04
Episode 45700/100000, Avg Reward: 5.04, Epsilon: 0.04
Episode 45800/100000, Avg Reward: 2.46, Epsilon: 0.04
Episode 45900/100000, Avg Reward: 5.63, Epsilon: 0.04
Episode 46000/100000, Avg Reward: 4.92, Epsilon: 0.04
Episode 46100/100000, Avg Reward: 6.85, Epsilon: 0.04
Episode 46200/100000, Avg Reward: 6.07, Epsilon: 0.04
Episode 46300/100000, Avg Reward: 5.29, Epsilon: 0.04
Episode 46400/100000, Avg Reward: 5.73, Epsilon: 0.04
Episode 46500/100000, Avg Reward: 5.46, Epsilon: 0.04
Episode 46600/100000, Avg Reward: 6.27, Epsilon: 0.04
Episode 46700/100000, Avg Reward: 6.30, Epsilon: 0.04
Episode 46800/100000, Avg Reward: 5.15, Epsilon: 0.04
Episode 46900/100000, Avg Reward: 5.21, Epsilon: 0.04
Episode 47000/100000, Avg Reward: 5.16, Epsilon: 0.04
Episode 47100/100000, Avg Reward: 6.42, Epsilon: 0.04
Episode 47200/100000, Avg Reward: 5.88, Epsilon: 0.04
Episode 47300/100000, Avg Reward: 5.71, Epsilon: 0.04
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Episode 47400/100000, Avg Reward: 5.86, Epsilon: 0.04
Episode 47500/100000, Avg Reward: 6.18, Epsilon: 0.04
Episode 47600/100000, Avg Reward: 6.20, Epsilon: 0.04
Episode 47700/100000, Avg Reward: 5.16, Epsilon: 0.04
Episode 47800/100000, Avg Reward: 6.23, Epsilon: 0.04
Episode 47900/100000, Avg Reward: 6.19, Epsilon: 0.04
Episode 48000/100000, Avg Reward: 6.02, Epsilon: 0.04
Episode 48100/100000, Avg Reward: 6.14, Epsilon: 0.04
Episode 48200/100000, Avg Reward: 6.17, Epsilon: 0.04
Episode 48300/100000, Avg Reward: 6.67, Epsilon: 0.04
Episode 48400/100000, Avg Reward: 6.38, Epsilon: 0.04
Episode 48500/100000, Avg Reward: 6.79, Epsilon: 0.04
Episode 48600/100000, Avg Reward: 6.04, Epsilon: 0.03
Episode 48700/100000, Avg Reward: 5.03, Epsilon: 0.03
Episode 48800/100000, Avg Reward: 6.93, Epsilon: 0.03
Episode 48900/100000, Avg Reward: 7.37, Epsilon: 0.03
Episode 49000/100000, Avg Reward: 2.66, Epsilon: 0.03
Episode 49100/100000, Avg Reward: 6.78, Epsilon: 0.03
Episode 49200/100000, Avg Reward: 5.62, Epsilon: 0.03
Episode 49300/100000, Avg Reward: 3.64, Epsilon: 0.03
Episode 49400/100000, Avg Reward: 3.52, Epsilon: 0.03
Episode 49500/100000, Avg Reward: 6.16, Epsilon: 0.03
Episode 49600/100000, Avg Reward: 6.46, Epsilon: 0.03
Episode 49700/100000, Avg Reward: 5.67, Epsilon: 0.03
Episode 49800/100000, Avg Reward: 6.50, Epsilon: 0.03
Episode 49900/100000, Avg Reward: 6.69, Epsilon: 0.03
Episode 50000/100000, Avg Reward: 6.16, Epsilon: 0.03
Episode 50100/100000, Avg Reward: 6.73, Epsilon: 0.03
Episode 50200/100000, Avg Reward: 6.54, Epsilon: 0.03
Episode 50300/100000, Avg Reward: 4.77, Epsilon: 0.03
Episode 50400/100000, Avg Reward: 6.08, Epsilon: 0.03
Episode 50500/100000, Avg Reward: 5.91, Epsilon: 0.03
Episode 50600/100000, Avg Reward: 3.51, Epsilon: 0.03
Episode 50700/100000, Avg Reward: 6.59, Epsilon: 0.03
Episode 50800/100000, Avg Reward: 6.24, Epsilon: 0.03
Episode 50900/100000, Avg Reward: 6.94, Epsilon: 0.03
Episode 51000/100000, Avg Reward: 6.82, Epsilon: 0.03
Episode 51100/100000, Avg Reward: 7.49, Epsilon: 0.03
Episode 51200/100000, Avg Reward: 6.79, Epsilon: 0.03
Episode 51300/100000, Avg Reward: 5.85, Epsilon: 0.03
Episode 51400/100000, Avg Reward: 6.48, Epsilon: 0.03
Episode 51500/100000, Avg Reward: 6.47, Epsilon: 0.03
Episode 51600/100000, Avg Reward: 6.63, Epsilon: 0.03
Episode 51700/100000, Avg Reward: 5.47, Epsilon: 0.03
Episode 51800/100000, Avg Reward: 6.40, Epsilon: 0.03
Episode 51900/100000, Avg Reward: 7.18, Epsilon: 0.03
Episode 52000/100000, Avg Reward: 4.75, Epsilon: 0.03
Episode 52100/100000, Avg Reward: 5.14, Epsilon: 0.03
Episode 52200/100000, Avg Reward: 6.90, Epsilon: 0.03
Episode 52300/100000, Avg Reward: 6.84, Epsilon: 0.03
Episode 52400/100000, Avg Reward: 6.39, Epsilon: 0.03
Episode 52500/100000, Avg Reward: 4.54, Epsilon: 0.03
Episode 52600/100000, Avg Reward: 6.69, Epsilon: 0.03
Episode 52700/100000, Avg Reward: 6.82, Epsilon: 0.03
Episode 52800/100000, Avg Reward: 5.62, Epsilon: 0.03
Episode 52900/100000, Avg Reward: 6.26, Epsilon: 0.03
Episode 53000/100000, Avg Reward: 7.09, Epsilon: 0.03
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Episode 53100/100000, Avg Reward: 5.78, Epsilon: 0.03
Episode 53200/100000, Avg Reward: 6.68, Epsilon: 0.03
Episode 53300/100000, Avg Reward: 4.33, Epsilon: 0.03
Episode 53400/100000, Avg Reward: 4.30, Epsilon: 0.03
Episode 53500/100000, Avg Reward: 4.67, Epsilon: 0.02
Episode 53600/100000, Avg Reward: 5.49, Epsilon: 0.02
Episode 53700/100000, Avg Reward: 6.30, Epsilon: 0.02
Episode 53800/100000, Avg Reward: 4.88, Epsilon: 0.02
Episode 53900/100000, Avg Reward: 6.97, Epsilon: 0.02
Episode 54000/100000, Avg Reward: 7.55, Epsilon: 0.02
Episode 54100/100000, Avg Reward: 6.37, Epsilon: 0.02
Episode 54200/100000, Avg Reward: 7.09, Epsilon: 0.02
Episode 54300/100000, Avg Reward: 6.19, Epsilon: 0.02
Episode 54400/100000, Avg Reward: 7.37, Epsilon: 0.02
Episode 54500/100000, Avg Reward: 7.02, Epsilon: 0.02
Episode 54600/100000, Avg Reward: 6.98, Epsilon: 0.02
Episode 54700/100000, Avg Reward: 1.96, Epsilon: 0.02
Episode 54800/100000, Avg Reward: 6.48, Epsilon: 0.02
Episode 54900/100000, Avg Reward: 2.21, Epsilon: 0.02
Episode 55000/100000, Avg Reward: 4.73, Epsilon: 0.02
Episode 55100/100000, Avg Reward: 6.84, Epsilon: 0.02
Episode 55200/100000, Avg Reward: 6.71, Epsilon: 0.02
Episode 55300/100000, Avg Reward: 6.17, Epsilon: 0.02
Episode 55400/100000, Avg Reward: 7.14, Epsilon: 0.02
Episode 55500/100000, Avg Reward: 6.97, Epsilon: 0.02
Episode 55600/100000, Avg Reward: 7.21, Epsilon: 0.02
Episode 55700/100000, Avg Reward: 4.63, Epsilon: 0.02
Episode 55800/100000, Avg Reward: 6.01, Epsilon: 0.02
Episode 55900/100000, Avg Reward: 6.78, Epsilon: 0.02
Episode 56000/100000, Avg Reward: 7.49, Epsilon: 0.02
Episode 56100/100000, Avg Reward: 7.17, Epsilon: 0.02
Episode 56200/100000, Avg Reward: 6.97, Epsilon: 0.02
Episode 56300/100000, Avg Reward: 7.16, Epsilon: 0.02
Episode 56400/100000, Avg Reward: 6.36, Epsilon: 0.02
Episode 56500/100000, Avg Reward: 6.60, Epsilon: 0.02
Episode 56600/100000, Avg Reward: 6.18, Epsilon: 0.02
Episode 56700/100000, Avg Reward: 7.08, Epsilon: 0.02
Episode 56800/100000, Avg Reward: 1.73, Epsilon: 0.02
Episode 56900/100000, Avg Reward: 6.27, Epsilon: 0.02
Episode 57000/100000, Avg Reward: 5.14, Epsilon: 0.02
Episode 57100/100000, Avg Reward: 7.08, Epsilon: 0.02
Episode 57200/100000, Avg Reward: 7.24, Epsilon: 0.02
Episode 57300/100000, Avg Reward: 6.68, Epsilon: 0.02
Episode 57400/100000, Avg Reward: 5.29, Epsilon: 0.02
Episode 57500/100000, Avg Reward: 7.02, Epsilon: 0.02
Episode 57600/100000, Avg Reward: 4.98, Epsilon: 0.02
Episode 57700/100000, Avg Reward: 5.08, Epsilon: 0.02
Episode 57800/100000, Avg Reward: 6.61, Epsilon: 0.02
Episode 57900/100000, Avg Reward: 3.42, Epsilon: 0.02
Episode 58000/100000, Avg Reward: 7.33, Epsilon: 0.02
Episode 58100/100000, Avg Reward: 6.64, Epsilon: 0.02
Episode 58200/100000, Avg Reward: 6.81, Epsilon: 0.02
Episode 58300/100000, Avg Reward: 7.38, Epsilon: 0.02
Episode 58400/100000, Avg Reward: 7.30, Epsilon: 0.02
Episode 58500/100000, Avg Reward: 6.59, Epsilon: 0.02
Episode 58600/100000, Avg Reward: 6.84, Epsilon: 0.02
Episode 58700/100000, Avg Reward: 6.97, Epsilon: 0.02
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Episode 58800/100000, Avg Reward: 7.19, Epsilon: 0.02
Episode 58900/100000, Avg Reward: 6.76, Epsilon: 0.02
Episode 59000/100000, Avg Reward: 7.37, Epsilon: 0.02
Episode 59100/100000, Avg Reward: 4.76, Epsilon: 0.02
Episode 59200/100000, Avg Reward: 7.28, Epsilon: 0.02
Episode 59300/100000, Avg Reward: 2.61, Epsilon: 0.02
Episode 59400/100000, Avg Reward: 7.50, Epsilon: 0.02
Episode 59500/100000, Avg Reward: 5.20, Epsilon: 0.02
Episode 59600/100000, Avg Reward: 2.95, Epsilon: 0.02
Episode 59700/100000, Avg Reward: 6.30, Epsilon: 0.02
Episode 59800/100000, Avg Reward: 6.17, Epsilon: 0.02
Episode 59900/100000, Avg Reward: 7.76, Epsilon: 0.02
Episode 60000/100000, Avg Reward: 6.88, Epsilon: 0.02
Episode 60100/100000, Avg Reward: 6.98, Epsilon: 0.02
Episode 60200/100000, Avg Reward: 7.15, Epsilon: 0.02
Episode 60300/100000, Avg Reward: 6.54, Epsilon: 0.02
Episode 60400/100000, Avg Reward: 6.68, Epsilon: 0.02
Episode 60500/100000, Avg Reward: 7.69, Epsilon: 0.02
Episode 60600/100000, Avg Reward: 7.47, Epsilon: 0.02
Episode 60700/100000, Avg Reward: 7.45, Epsilon: 0.02
Episode 60800/100000, Avg Reward: 5.12, Epsilon: 0.01
Episode 60900/100000, Avg Reward: 2.69, Epsilon: 0.01
Episode 61000/100000, Avg Reward: 7.04, Epsilon: 0.01
Episode 61100/100000, Avg Reward: 6.81, Epsilon: 0.01
Episode 61200/100000, Avg Reward: 5.43, Epsilon: 0.01
Episode 61300/100000, Avg Reward: 5.04, Epsilon: 0.01
Episode 61400/100000, Avg Reward: -1.30, Epsilon: 0.01
Episode 61500/100000, Avg Reward: 7.69, Epsilon: 0.01
Episode 61600/100000, Avg Reward: 7.72, Epsilon: 0.01
Episode 61700/100000, Avg Reward: 6.87, Epsilon: 0.01
Episode 61800/100000, Avg Reward: 6.88, Epsilon: 0.01
Episode 61900/100000, Avg Reward: 7.12, Epsilon: 0.01
Episode 62000/100000, Avg Reward: 6.29, Epsilon: 0.01
Episode 62100/100000, Avg Reward: 6.79, Epsilon: 0.01
Episode 62200/100000, Avg Reward: 7.58, Epsilon: 0.01
Episode 62300/100000, Avg Reward: 7.74, Epsilon: 0.01
Episode 62400/100000, Avg Reward: 7.36, Epsilon: 0.01
Episode 62500/100000, Avg Reward: 7.40, Epsilon: 0.01
Episode 62600/100000, Avg Reward: 3.19, Epsilon: 0.01
Episode 62700/100000, Avg Reward: 7.03, Epsilon: 0.01
Episode 62800/100000, Avg Reward: 7.14, Epsilon: 0.01
Episode 62900/100000, Avg Reward: 7.29, Epsilon: 0.01
Episode 63000/100000, Avg Reward: 7.74, Epsilon: 0.01
Episode 63100/100000, Avg Reward: 5.38, Epsilon: 0.01
Episode 63200/100000, Avg Reward: 3.05, Epsilon: 0.01
Episode 63300/100000, Avg Reward: 7.25, Epsilon: 0.01
Episode 63400/100000, Avg Reward: 6.97, Epsilon: 0.01
Episode 63500/100000, Avg Reward: 7.56, Epsilon: 0.01
Episode 63600/100000, Avg Reward: 7.21, Epsilon: 0.01
Episode 63700/100000, Avg Reward: 7.28, Epsilon: 0.01
Episode 63800/100000, Avg Reward: 0.43, Epsilon: 0.01
Episode 63900/100000, Avg Reward: 4.78, Epsilon: 0.01
Episode 64000/100000, Avg Reward: 5.02, Epsilon: 0.01
Episode 64100/100000, Avg Reward: 7.18, Epsilon: 0.01
Episode 64200/100000, Avg Reward: 6.97, Epsilon: 0.01
Episode 64300/100000, Avg Reward: 7.48, Epsilon: 0.01
Episode 64400/100000, Avg Reward: 7.30, Epsilon: 0.01
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Episode 64500/100000, Avg Reward: 7.67, Epsilon: 0.01
Episode 64600/100000, Avg Reward: 6.54, Epsilon: 0.01
Episode 64700/100000, Avg Reward: 6.96, Epsilon: 0.01
Episode 64800/100000, Avg Reward: 5.91, Epsilon: 0.01
Episode 64900/100000, Avg Reward: 4.63, Epsilon: 0.01
Episode 65000/100000, Avg Reward: 7.14, Epsilon: 0.01
Episode 65100/100000, Avg Reward: 7.24, Epsilon: 0.01
Episode 65200/100000, Avg Reward: 5.66, Epsilon: 0.01
Episode 65300/100000, Avg Reward: 7.40, Epsilon: 0.01
Episode 65400/100000, Avg Reward: 7.23, Epsilon: 0.01
Episode 65500/100000, Avg Reward: 7.45, Epsilon: 0.01
Episode 65600/100000, Avg Reward: 7.82, Epsilon: 0.01
Episode 65700/100000, Avg Reward: 7.62, Epsilon: 0.01
Episode 65800/100000, Avg Reward: 4.52, Epsilon: 0.01
Episode 65900/100000, Avg Reward: 7.46, Epsilon: 0.01
Episode 66000/100000, Avg Reward: 7.18, Epsilon: 0.01
Episode 66100/100000, Avg Reward: 5.71, Epsilon: 0.01
Episode 66200/100000, Avg Reward: 7.46, Epsilon: 0.01
Episode 66300/100000, Avg Reward: 7.48, Epsilon: 0.01
Episode 66400/100000, Avg Reward: 6.83, Epsilon: 0.01
Episode 66500/100000, Avg Reward: 7.68, Epsilon: 0.01
Episode 66600/100000, Avg Reward: 5.34, Epsilon: 0.01
Episode 66700/100000, Avg Reward: 5.26, Epsilon: 0.01
Episode 66800/100000, Avg Reward: 7.94, Epsilon: 0.01
Episode 66900/100000, Avg Reward: 7.42, Epsilon: 0.01
Episode 67000/100000, Avg Reward: 7.70, Epsilon: 0.01
Episode 67100/100000, Avg Reward: 7.77, Epsilon: 0.01
Episode 67200/100000, Avg Reward: 7.86, Epsilon: 0.01
Episode 67300/100000, Avg Reward: 7.60, Epsilon: 0.01
Episode 67400/100000, Avg Reward: 7.28, Epsilon: 0.01
Episode 67500/100000, Avg Reward: 3.56, Epsilon: 0.01
Episode 67600/100000, Avg Reward: 4.71, Epsilon: 0.01
Episode 67700/100000, Avg Reward: 7.27, Epsilon: 0.01
Episode 67800/100000, Avg Reward: 7.39, Epsilon: 0.01
Episode 67900/100000, Avg Reward: 7.26, Epsilon: 0.01
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Episode 68100/100000, Avg Reward: 7.10, Epsilon: 0.01
Episode 68200/100000, Avg Reward: 7.04, Epsilon: 0.01
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Episode 68400/100000, Avg Reward: 7.13, Epsilon: 0.01
Episode 68500/100000, Avg Reward: 1.28, Epsilon: 0.01
Episode 68600/100000, Avg Reward: 6.55, Epsilon: 0.01
Episode 68700/100000, Avg Reward: 4.80, Epsilon: 0.01
Episode 68800/100000, Avg Reward: 7.27, Epsilon: 0.01
Episode 68900/100000, Avg Reward: 7.24, Epsilon: 0.01
Episode 69000/100000, Avg Reward: 7.45, Epsilon: 0.01
Episode 69100/100000, Avg Reward: 7.51, Epsilon: 0.01
Episode 69200/100000, Avg Reward: 7.17, Epsilon: 0.01
Episode 69300/100000, Avg Reward: 6.87, Epsilon: 0.01
Episode 69400/100000, Avg Reward: 7.73, Epsilon: 0.01
Episode 69500/100000, Avg Reward: 7.18, Epsilon: 0.01
Episode 69600/100000, Avg Reward: 7.71, Epsilon: 0.01
Episode 69700/100000, Avg Reward: 7.52, Epsilon: 0.01
Episode 69800/100000, Avg Reward: 7.47, Epsilon: 0.01
Episode 69900/100000, Avg Reward: 7.55, Epsilon: 0.01
Episode 70000/100000, Avg Reward: 7.64, Epsilon: 0.01
Episode 70100/100000, Avg Reward: 4.00, Epsilon: 0.01
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Episode 70300/100000, Avg Reward: 7.89, Epsilon: 0.01
Episode 70400/100000, Avg Reward: 8.00, Epsilon: 0.01
Episode 70500/100000, Avg Reward: 7.85, Epsilon: 0.01
Episode 70600/100000, Avg Reward: 7.51, Epsilon: 0.01
Episode 70700/100000, Avg Reward: 7.80, Epsilon: 0.01
Episode 70800/100000, Avg Reward: 7.82, Epsilon: 0.01
Episode 70900/100000, Avg Reward: 5.69, Epsilon: 0.01
Episode 71000/100000, Avg Reward: 1.30, Epsilon: 0.01
Episode 71100/100000, Avg Reward: 4.85, Epsilon: 0.01
Episode 71200/100000, Avg Reward: 7.95, Epsilon: 0.01
Episode 71300/100000, Avg Reward: 7.49, Epsilon: 0.01
Episode 71400/100000, Avg Reward: 7.57, Epsilon: 0.01
Episode 71500/100000, Avg Reward: 8.30, Epsilon: 0.01
Episode 71600/100000, Avg Reward: 8.15, Epsilon: 0.01
Episode 71700/100000, Avg Reward: 7.65, Epsilon: 0.01
Episode 71800/100000, Avg Reward: 7.32, Epsilon: 0.01
Episode 71900/100000, Avg Reward: 7.24, Epsilon: 0.01
Episode 72000/100000, Avg Reward: 5.70, Epsilon: 0.01
Episode 72100/100000, Avg Reward: 6.95, Epsilon: 0.01
Episode 72200/100000, Avg Reward: 5.23, Epsilon: 0.01
Episode 72300/100000, Avg Reward: 7.38, Epsilon: 0.01
Episode 72400/100000, Avg Reward: 5.60, Epsilon: 0.01
Episode 72500/100000, Avg Reward: 7.58, Epsilon: 0.01
Episode 72600/100000, Avg Reward: 7.52, Epsilon: 0.01
Episode 72700/100000, Avg Reward: 7.46, Epsilon: 0.01
Episode 72800/100000, Avg Reward: 7.58, Epsilon: 0.01
Episode 72900/100000, Avg Reward: 7.83, Epsilon: 0.01
Episode 73000/100000, Avg Reward: 7.43, Epsilon: 0.01
Episode 73100/100000, Avg Reward: 7.67, Epsilon: 0.01
Episode 73200/100000, Avg Reward: 5.46, Epsilon: 0.01
Episode 73300/100000, Avg Reward: 5.86, Epsilon: 0.01
Episode 73400/100000, Avg Reward: 7.36, Epsilon: 0.01
Episode 73500/100000, Avg Reward: 7.86, Epsilon: 0.01
Episode 73600/100000, Avg Reward: 7.63, Epsilon: 0.01
Episode 73700/100000, Avg Reward: 7.85, Epsilon: 0.01
Episode 73800/100000, Avg Reward: 7.71, Epsilon: 0.01
Episode 73900/100000, Avg Reward: 8.06, Epsilon: 0.01
Episode 74000/100000, Avg Reward: 7.78, Epsilon: 0.01
Episode 74100/100000, Avg Reward: 2.87, Epsilon: 0.01
Episode 74200/100000, Avg Reward: 5.79, Epsilon: 0.01
Episode 74300/100000, Avg Reward: 6.09, Epsilon: 0.01
Episode 74400/100000, Avg Reward: 8.24, Epsilon: 0.01
Episode 74500/100000, Avg Reward: 7.58, Epsilon: 0.01
Episode 74600/100000, Avg Reward: 8.13, Epsilon: 0.01
Episode 74700/100000, Avg Reward: 7.88, Epsilon: 0.01
Episode 74800/100000, Avg Reward: 8.03, Epsilon: 0.01
Episode 74900/100000, Avg Reward: 7.54, Epsilon: 0.01
Episode 75000/100000, Avg Reward: 7.22, Epsilon: 0.01
Episode 75100/100000, Avg Reward: 7.78, Epsilon: 0.01
Episode 75200/100000, Avg Reward: 7.82, Epsilon: 0.01
Episode 75300/100000, Avg Reward: 7.22, Epsilon: 0.01
Episode 75400/100000, Avg Reward: 7.86, Epsilon: 0.01
Episode 75500/100000, Avg Reward: 7.53, Epsilon: 0.01
Episode 75600/100000, Avg Reward: 5.82, Epsilon: 0.01
Episode 75700/100000, Avg Reward: 2.90, Epsilon: 0.01
Episode 75800/100000, Avg Reward: 7.96, Epsilon: 0.01
```

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Episode 75900/100000, Avg Reward: 6.47, Epsilon: 0.01
Episode 76000/100000, Avg Reward: 7.35, Epsilon: 0.01
Episode 76100/100000, Avg Reward: 7.62, Epsilon: 0.01
Episode 76200/100000, Avg Reward: 7.86, Epsilon: 0.01
Episode 76300/100000, Avg Reward: 7.88, Epsilon: 0.01
Episode 76400/100000, Avg Reward: 7.28, Epsilon: 0.01
Episode 76500/100000, Avg Reward: 1.60, Epsilon: 0.01
Episode 76600/100000, Avg Reward: 8.27, Epsilon: 0.01
Episode 76700/100000, Avg Reward: 8.16, Epsilon: 0.01
Episode 76800/100000, Avg Reward: 7.40, Epsilon: 0.00
Episode 76900/100000, Avg Reward: 7.67, Epsilon: 0.00
Episode 77000/100000, Avg Reward: 5.31, Epsilon: 0.00
Episode 77100/100000, Avg Reward: 7.07, Epsilon: 0.00
Episode 77200/100000, Avg Reward: 7.84, Epsilon: 0.00
Episode 77300/100000, Avg Reward: 7.66, Epsilon: 0.00
Episode 77400/100000, Avg Reward: 7.90, Epsilon: 0.00
Episode 77500/100000, Avg Reward: 5.93, Epsilon: 0.00
Episode 77600/100000, Avg Reward: 8.08, Epsilon: 0.00
Episode 77700/100000, Avg Reward: 7.76, Epsilon: 0.00
Episode 77800/100000, Avg Reward: 3.48, Epsilon: 0.00
Episode 77900/100000, Avg Reward: 7.83, Epsilon: 0.00
Episode 78000/100000, Avg Reward: 7.21, Epsilon: 0.00
Episode 78100/100000, Avg Reward: 7.39, Epsilon: 0.00
Episode 78200/100000, Avg Reward: 7.37, Epsilon: 0.00
Episode 78300/100000, Avg Reward: 7.26, Epsilon: 0.00
Episode 78400/100000, Avg Reward: -2.39, Epsilon: 0.00
Episode 78500/100000, Avg Reward: 5.71, Epsilon: 0.00
Episode 78600/100000, Avg Reward: -0.81, Epsilon: 0.00
Episode 78700/100000, Avg Reward: 7.71, Epsilon: 0.00
Episode 78800/100000, Avg Reward: 7.70, Epsilon: 0.00
Episode 78900/100000, Avg Reward: 7.96, Epsilon: 0.00
Episode 79000/100000, Avg Reward: 5.58, Epsilon: 0.00
Episode 79100/100000, Avg Reward: 7.39, Epsilon: 0.00
Episode 79200/100000, Avg Reward: 7.59, Epsilon: 0.00
Episode 79300/100000, Avg Reward: 7.59, Epsilon: 0.00
Episode 79400/100000, Avg Reward: 8.21, Epsilon: 0.00
Episode 79500/100000, Avg Reward: 7.58, Epsilon: 0.00
Episode 79600/100000, Avg Reward: 7.84, Epsilon: 0.00
Episode 79700/100000, Avg Reward: 7.78, Epsilon: 0.00
Episode 79800/100000, Avg Reward: 7.45, Epsilon: 0.00
Episode 79900/100000, Avg Reward: 7.54, Epsilon: 0.00
Episode 80000/100000, Avg Reward: 8.12, Epsilon: 0.00
Episode 80100/100000, Avg Reward: 7.49, Epsilon: 0.00
Episode 80200/100000, Avg Reward: 8.30, Epsilon: 0.00
Episode 80300/100000, Avg Reward: 7.39, Epsilon: 0.00
Episode 80400/100000, Avg Reward: 1.22, Epsilon: 0.00
Episode 80500/100000, Avg Reward: 4.04, Epsilon: 0.00
Episode 80600/100000, Avg Reward: 7.67, Epsilon: 0.00
Episode 80700/100000, Avg Reward: 4.09, Epsilon: 0.00
Episode 80800/100000, Avg Reward: 5.85, Epsilon: 0.00
Episode 80900/100000, Avg Reward: 7.37, Epsilon: 0.00
Episode 81000/100000, Avg Reward: 7.92, Epsilon: 0.00
Episode 81100/100000, Avg Reward: 8.07, Epsilon: 0.00
Episode 81200/100000, Avg Reward: 5.67, Epsilon: 0.00
Episode 81300/100000, Avg Reward: 7.64, Epsilon: 0.00
Episode 81400/100000, Avg Reward: 7.86, Epsilon: 0.00
Episode 81500/100000, Avg Reward: 7.81, Epsilon: 0.00
```

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Episode 81600/100000, Avg Reward: 7.42, Epsilon: 0.00
Episode 81700/100000, Avg Reward: 7.66, Epsilon: 0.00
Episode 81800/100000, Avg Reward: 7.62, Epsilon: 0.00
Episode 81900/100000, Avg Reward: 7.79, Epsilon: 0.00
Episode 82000/100000, Avg Reward: 7.81, Epsilon: 0.00
Episode 82100/100000, Avg Reward: 8.08, Epsilon: 0.00
Episode 82200/100000, Avg Reward: 7.89, Epsilon: 0.00
Episode 82300/100000, Avg Reward: 7.63, Epsilon: 0.00
Episode 82400/100000, Avg Reward: 7.66, Epsilon: 0.00
Episode 82500/100000, Avg Reward: 7.46, Epsilon: 0.00
Episode 82600/100000, Avg Reward: 7.80, Epsilon: 0.00
Episode 82700/100000, Avg Reward: 7.61, Epsilon: 0.00
Episode 82800/100000, Avg Reward: 7.69, Epsilon: 0.00
Episode 82900/100000, Avg Reward: 5.69, Epsilon: 0.00
Episode 83000/100000, Avg Reward: 4.19, Epsilon: 0.00
Episode 83100/100000, Avg Reward: 7.84, Epsilon: 0.00
Episode 83200/100000, Avg Reward: 5.82, Epsilon: 0.00
Episode 83300/100000, Avg Reward: 6.63, Epsilon: 0.00
Episode 83400/100000, Avg Reward: 7.36, Epsilon: 0.00
Episode 83500/100000, Avg Reward: 7.69, Epsilon: 0.00
Episode 83600/100000, Avg Reward: 8.08, Epsilon: 0.00
Episode 83700/100000, Avg Reward: 7.57, Epsilon: 0.00
Episode 83800/100000, Avg Reward: 7.17, Epsilon: 0.00
Episode 83900/100000, Avg Reward: 4.52, Epsilon: 0.00
Episode 84000/100000, Avg Reward: 7.92, Epsilon: 0.00
Episode 84100/100000, Avg Reward: 8.15, Epsilon: 0.00
Episode 84200/100000, Avg Reward: 7.72, Epsilon: 0.00
Episode 84300/100000, Avg Reward: 7.74, Epsilon: 0.00
Episode 84400/100000, Avg Reward: 5.89, Epsilon: 0.00
Episode 84500/100000, Avg Reward: 7.97, Epsilon: 0.00
Episode 84600/100000, Avg Reward: 8.16, Epsilon: 0.00
Episode 84700/100000, Avg Reward: 7.93, Epsilon: 0.00
Episode 84800/100000, Avg Reward: 7.43, Epsilon: 0.00
Episode 84900/100000, Avg Reward: 7.81, Epsilon: 0.00
Episode 85000/100000, Avg Reward: 7.96, Epsilon: 0.00
Episode 85100/100000, Avg Reward: 1.91, Epsilon: 0.00
Episode 85200/100000, Avg Reward: 3.93, Epsilon: 0.00
Episode 85300/100000, Avg Reward: 4.03, Epsilon: 0.00
Episode 85400/100000, Avg Reward: 7.57, Epsilon: 0.00
Episode 85500/100000, Avg Reward: 7.46, Epsilon: 0.00
Episode 85600/100000, Avg Reward: 8.06, Epsilon: 0.00
Episode 85700/100000, Avg Reward: 7.81, Epsilon: 0.00
Episode 85800/100000, Avg Reward: 7.80, Epsilon: 0.00
Episode 85900/100000, Avg Reward: 8.07, Epsilon: 0.00
Episode 86000/100000, Avg Reward: 7.96, Epsilon: 0.00
Episode 86100/100000, Avg Reward: 8.06, Epsilon: 0.00
Episode 86200/100000, Avg Reward: 7.56, Epsilon: 0.00
Episode 86300/100000, Avg Reward: 7.59, Epsilon: 0.00
Episode 86400/100000, Avg Reward: 8.50, Epsilon: 0.00
Episode 86500/100000, Avg Reward: 7.75, Epsilon: 0.00
Episode 86600/100000, Avg Reward: 7.58, Epsilon: 0.00
Episode 86700/100000, Avg Reward: 5.92, Epsilon: 0.00
Episode 86800/100000, Avg Reward: 7.58, Epsilon: 0.00
Episode 86900/100000, Avg Reward: 8.03, Epsilon: 0.00
Episode 87000/100000, Avg Reward: 7.65, Epsilon: 0.00
Episode 87100/100000, Avg Reward: 7.82, Epsilon: 0.00
Episode 87200/100000, Avg Reward: 7.52, Epsilon: 0.00
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Episode 87300/100000, Avg Reward: 8.24, Epsilon: 0.00
Episode 87400/100000, Avg Reward: 8.10, Epsilon: 0.00
Episode 87500/100000, Avg Reward: 7.76, Epsilon: 0.00
Episode 87600/100000, Avg Reward: 7.88, Epsilon: 0.00
Episode 87700/100000, Avg Reward: 8.10, Epsilon: 0.00
Episode 87800/100000, Avg Reward: 7.99, Epsilon: 0.00
Episode 87900/100000, Avg Reward: 7.67, Epsilon: 0.00
Episode 88000/100000, Avg Reward: 7.76, Epsilon: 0.00
Episode 88100/100000, Avg Reward: 7.79, Epsilon: 0.00
Episode 88200/100000, Avg Reward: 8.25, Epsilon: 0.00
Episode 88300/100000, Avg Reward: 5.84, Epsilon: 0.00
Episode 88400/100000, Avg Reward: 7.67, Epsilon: 0.00
Episode 88500/100000, Avg Reward: 7.27, Epsilon: 0.00
Episode 88600/100000, Avg Reward: 7.73, Epsilon: 0.00
Episode 88700/100000, Avg Reward: 3.70, Epsilon: 0.00
Episode 88800/100000, Avg Reward: 7.95, Epsilon: 0.00
Episode 88900/100000, Avg Reward: 7.98, Epsilon: 0.00
Episode 89000/100000, Avg Reward: 7.88, Epsilon: 0.00
Episode 89100/100000, Avg Reward: 7.92, Epsilon: 0.00
Episode 89200/100000, Avg Reward: 7.73, Epsilon: 0.00
Episode 89300/100000, Avg Reward: 7.78, Epsilon: 0.00
Episode 89400/100000, Avg Reward: 3.59, Epsilon: 0.00
Episode 89500/100000, Avg Reward: 3.59, Epsilon: 0.00
Episode 89600/100000, Avg Reward: 7.91, Epsilon: 0.00
Episode 89700/100000, Avg Reward: 7.46, Epsilon: 0.00
Episode 89800/100000, Avg Reward: 7.67, Epsilon: 0.00
Episode 89900/100000, Avg Reward: 7.94, Epsilon: 0.00
Episode 90000/100000, Avg Reward: 7.88, Epsilon: 0.00
Episode 90100/100000, Avg Reward: 7.64, Epsilon: 0.00
Episode 90200/100000, Avg Reward: 7.85, Epsilon: 0.00
Episode 90300/100000, Avg Reward: 6.40, Epsilon: 0.00
Episode 90400/100000, Avg Reward: 7.92, Epsilon: 0.00
Episode 90500/100000, Avg Reward: 7.51, Epsilon: 0.00
Episode 90600/100000, Avg Reward: 8.26, Epsilon: 0.00
Episode 90700/100000, Avg Reward: 8.17, Epsilon: 0.00
Episode 90800/100000, Avg Reward: 8.15, Epsilon: 0.00
Episode 90900/100000, Avg Reward: 3.72, Epsilon: 0.00
Episode 91000/100000, Avg Reward: 3.25, Epsilon: 0.00
Episode 91100/100000, Avg Reward: 7.43, Epsilon: 0.00
Episode 91200/100000, Avg Reward: 7.64, Epsilon: 0.00
Episode 91300/100000, Avg Reward: 8.33, Epsilon: 0.00
Episode 91400/100000, Avg Reward: 5.56, Epsilon: 0.00
Episode 91500/100000, Avg Reward: 7.68, Epsilon: 0.00
Episode 91600/100000, Avg Reward: 7.61, Epsilon: 0.00
Episode 91700/100000, Avg Reward: 7.73, Epsilon: 0.00
Episode 91800/100000, Avg Reward: 8.28, Epsilon: 0.00
Episode 91900/100000, Avg Reward: 7.92, Epsilon: 0.00
Episode 92000/100000, Avg Reward: 4.11, Epsilon: 0.00
Episode 92100/100000, Avg Reward: 7.82, Epsilon: 0.00
Episode 92200/100000, Avg Reward: 7.80, Epsilon: 0.00
Episode 92300/100000, Avg Reward: 3.74, Epsilon: 0.00
Episode 92400/100000, Avg Reward: 8.05, Epsilon: 0.00
Episode 92500/100000, Avg Reward: 7.47, Epsilon: 0.00
Episode 92600/100000, Avg Reward: 5.56, Epsilon: 0.00
Episode 92700/100000, Avg Reward: 8.35, Epsilon: 0.00
Episode 92800/100000, Avg Reward: 7.57, Epsilon: 0.00
Episode 92900/100000, Avg Reward: 7.52, Epsilon: 0.00
```

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Episode 93000/100000, Avg Reward: 8.32, Epsilon: 0.00
Episode 93100/100000, Avg Reward: 8.07, Epsilon: 0.00
Episode 93200/100000, Avg Reward: 5.02, Epsilon: 0.00
Episode 93300/100000, Avg Reward: 7.47, Epsilon: 0.00
Episode 93400/100000, Avg Reward: 7.63, Epsilon: 0.00
Episode 93500/100000, Avg Reward: 7.42, Epsilon: 0.00
Episode 93600/100000, Avg Reward: 5.56, Epsilon: 0.00
Episode 93700/100000, Avg Reward: 5.90, Epsilon: 0.00
Episode 93800/100000, Avg Reward: 7.82, Epsilon: 0.00
Episode 93900/100000, Avg Reward: 8.49, Epsilon: 0.00
Episode 94000/100000, Avg Reward: 7.96, Epsilon: 0.00
Episode 94100/100000, Avg Reward: 8.05, Epsilon: 0.00
Episode 94200/100000, Avg Reward: 7.49, Epsilon: 0.00
Episode 94300/100000, Avg Reward: 8.25, Epsilon: 0.00
Episode 94400/100000, Avg Reward: 5.53, Epsilon: 0.00
Episode 94500/100000, Avg Reward: 6.00, Epsilon: 0.00
Episode 94600/100000, Avg Reward: 5.50, Epsilon: 0.00
Episode 94700/100000, Avg Reward: 7.70, Epsilon: 0.00
Episode 94800/100000, Avg Reward: 5.40, Epsilon: 0.00
Episode 94900/100000, Avg Reward: 7.69, Epsilon: 0.00
Episode 95000/100000, Avg Reward: 8.18, Epsilon: 0.00
Episode 95100/100000, Avg Reward: 7.44, Epsilon: 0.00
Episode 95200/100000, Avg Reward: 7.60, Epsilon: 0.00
Episode 95300/100000, Avg Reward: 7.76, Epsilon: 0.00
Episode 95400/100000, Avg Reward: 7.51, Epsilon: 0.00
Episode 95500/100000, Avg Reward: 7.85, Epsilon: 0.00
Episode 95600/100000, Avg Reward: 6.19, Epsilon: 0.00
Episode 95700/100000, Avg Reward: -0.08, Epsilon: 0.00
Episode 95800/100000, Avg Reward: 7.97, Epsilon: 0.00
Episode 95900/100000, Avg Reward: 5.65, Epsilon: 0.00
Episode 96000/100000, Avg Reward: 6.14, Epsilon: 0.00
Episode 96100/100000, Avg Reward: 7.73, Epsilon: 0.00
Episode 96200/100000, Avg Reward: 3.74, Epsilon: 0.00
Episode 96300/100000, Avg Reward: 7.82, Epsilon: 0.00
Episode 96400/100000, Avg Reward: 5.70, Epsilon: 0.00
Episode 96500/100000, Avg Reward: 7.92, Epsilon: 0.00
Episode 96600/100000, Avg Reward: 7.71, Epsilon: 0.00
Episode 96700/100000, Avg Reward: 7.52, Epsilon: 0.00
Episode 96800/100000, Avg Reward: 7.39, Epsilon: 0.00
Episode 96900/100000, Avg Reward: 8.01, Epsilon: 0.00
Episode 97000/100000, Avg Reward: 3.95, Epsilon: 0.00
Episode 97100/100000, Avg Reward: 3.51, Epsilon: 0.00
Episode 97200/100000, Avg Reward: 7.69, Epsilon: 0.00
Episode 97300/100000, Avg Reward: 6.17, Epsilon: 0.00
Episode 97400/100000, Avg Reward: 7.46, Epsilon: 0.00
Episode 97500/100000, Avg Reward: 7.90, Epsilon: 0.00
Episode 97600/100000, Avg Reward: 8.05, Epsilon: 0.00
Episode 97700/100000, Avg Reward: 7.84, Epsilon: 0.00
Episode 97800/100000, Avg Reward: 7.74, Epsilon: 0.00
Episode 97900/100000, Avg Reward: 8.14, Epsilon: 0.00
Episode 98000/100000, Avg Reward: 5.62, Epsilon: 0.00
Episode 98100/100000, Avg Reward: 6.03, Epsilon: 0.00
Episode 98200/100000, Avg Reward: 7.76, Epsilon: 0.00
Episode 98300/100000, Avg Reward: 8.00, Epsilon: 0.00
Episode 98400/100000, Avg Reward: 8.08, Epsilon: 0.00
Episode 98500/100000, Avg Reward: 7.54, Epsilon: 0.00
Episode 98600/100000, Avg Reward: 7.82, Epsilon: 0.00
```

```
Episode 98700/100000, Avg Reward: 7.84, Epsilon: 0.00
Episode 98800/100000, Avg Reward: 5.72, Epsilon: 0.00
Episode 98900/100000, Avg Reward: 5.67, Epsilon: 0.00
Episode 99000/100000, Avg Reward: 7.57, Epsilon: 0.00
Episode 99100/100000, Avg Reward: 7.58, Epsilon: 0.00
Episode 99200/100000, Avg Reward: 8.03, Epsilon: 0.00
Episode 99300/100000, Avg Reward: 5.59, Epsilon: 0.00
Episode 99400/100000, Avg Reward: 7.81, Epsilon: 0.00
Episode 99500/100000, Avg Reward: 7.98, Epsilon: 0.00
Episode 99600/100000, Avg Reward: 8.39, Epsilon: 0.00
Episode 99700/100000, Avg Reward: 7.72, Epsilon: 0.00
Episode 99800/100000, Avg Reward: 7.48, Epsilon: 0.00
Episode 99900/100000, Avg Reward: 5.52, Epsilon: 0.00
Episode 100000/100000, Avg Reward: 7.72, Epsilon: 0.00
!!!!!!!!!!!!!!!!Trained and Stored the model successfully!!!!!!!!!!!!!!!!!
CPU times: user 1h 25min 6s, sys: 5min 32s, total: 1h 30min 38s
Wall time: 23min 9s
```
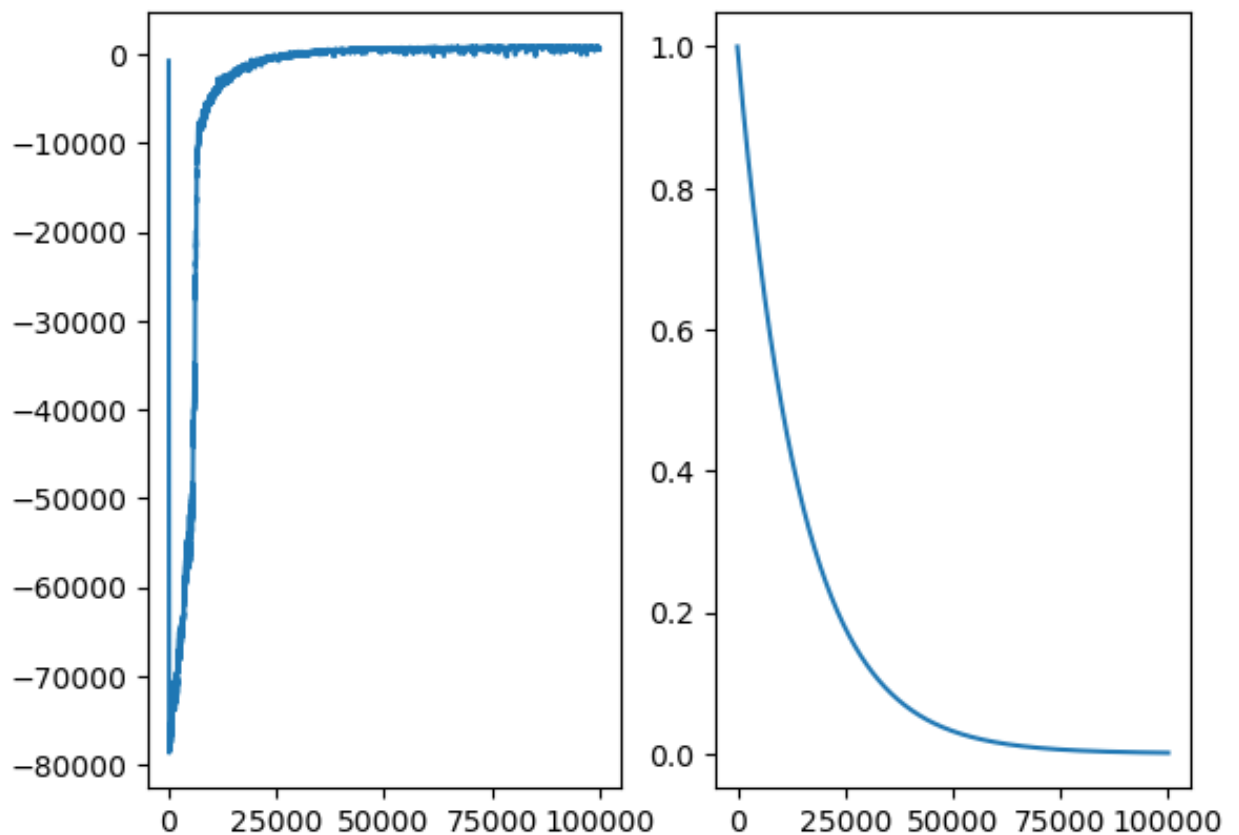

In [106… `print(my_dqn_agent_fine_tuned_training_rewards)`

```
[-722. -276. -794. ...    6.    14.     4.]
```

In [107…
```
fine_tuned_training = {
    "my_q_agent_fine_tuned_training_rewards": list(my_q_agent_fine_tuned_tr
    "my_dqn_agent_fine_tuned_training_rewards": list(my_dqn_agent_fine_tune
}
```

In [112…
```
print(type(my_q_agent_fine_tuned_training_rewards))
print(type(my_dqn_agent_fine_tuned_training_rewards))
```

```
<class 'numpy.ndarray'>
<class 'numpy.ndarray'>
```

In [114… `with open("fine_tuned_training.json", "w") as f:`

```
        json.dump(fine_tuned_training , f)
```

In [116…
```
with open("fine_tuned_training.json", "r") as f:
    fine_tuned_training_dict = json.load(f)
```

Compare the training reward

In [119…
```
x = range(1,100000 + 1)

plt.figure(figsize=(10, 6))
plt.plot(x, fine_tuned_training_dict["my_dqn_agent_fine_tuned_training_re
plt.plot(x, fine_tuned_training_dict["my_q_agent_fine_tuned_training_rewa

# titles and labels
plt.title('Prediction Comparison (Fine Tuned Unique Parameters)')
plt.xlabel('Time Episodes')
plt.ylabel('Average Reward')
plt.legend()
# display
plt.grid(True)
plt.show()
```
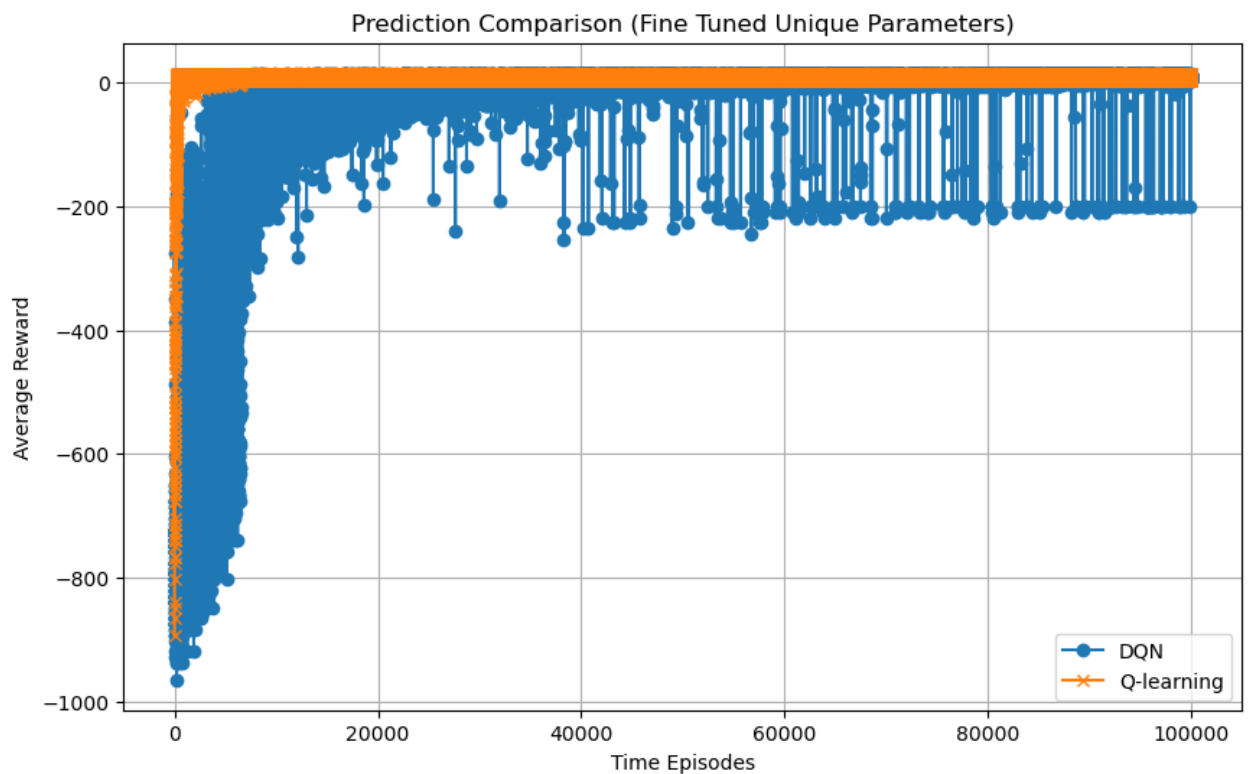

Prediction with the Fine-tunred models

Q Learning Agent with Fine Tuned Parameters

In [125…
```
my_q_agent_fine_tuned_avg_reward_lst = my_q_agent_fine_tuned.test(test_ep
```

```
========================================================
EPISODE  0
Score of total rewards: 5
========================================================
EPISODE  1
```

```
Score of total rewards: 4
========================================================
EPISODE  2
Score of total rewards: 10
========================================================
EPISODE  3
Score of total rewards: 11
========================================================
EPISODE  4
Score of total rewards: 6
========================================================
EPISODE  5
Score of total rewards: 7
========================================================
EPISODE  6
Score of total rewards: 10
========================================================
EPISODE  7
Score of total rewards: 5
========================================================
EPISODE  8
Score of total rewards: 4
========================================================
EPISODE  9
Score of total rewards: 6
========================================================
EPISODE  10
Score of total rewards: 6
========================================================
EPISODE  11
Score of total rewards: 7
========================================================
EPISODE  12
Score of total rewards: 8
========================================================
EPISODE  13
Score of total rewards: 6
========================================================
EPISODE  14
Score of total rewards: 6
========================================================
EPISODE  15
Score of total rewards: 8
========================================================
EPISODE  16
Score of total rewards: 9
========================================================
EPISODE  17
Score of total rewards: 4
========================================================
EPISODE  18
Score of total rewards: 5
========================================================
EPISODE  19
Score of total rewards: 6
========================================================
EPISODE  20
```

```
Score of total rewards: 8
========================================================
EPISODE  21
Score of total rewards: 6
========================================================
EPISODE  22
Score of total rewards: 10
========================================================
EPISODE  23
Score of total rewards: 5
========================================================
EPISODE  24
Score of total rewards: 13
========================================================
EPISODE  25
Score of total rewards: 11
========================================================
EPISODE  26
Score of total rewards: 8
========================================================
EPISODE  27
Score of total rewards: 7
========================================================
EPISODE  28
Score of total rewards: 8
========================================================
EPISODE  29
Score of total rewards: 14
========================================================
EPISODE  30
Score of total rewards: 5
========================================================
EPISODE  31
Score of total rewards: 3
========================================================
EPISODE  32
Score of total rewards: 8
========================================================
EPISODE  33
Score of total rewards: 5
========================================================
EPISODE  34
Score of total rewards: 12
========================================================
EPISODE  35
Score of total rewards: 9
========================================================
EPISODE  36
Score of total rewards: 7
========================================================
EPISODE  37
Score of total rewards: 8
========================================================
EPISODE  38
Score of total rewards: 4
========================================================
EPISODE  39
```

```
Score of total rewards: 11
===========================================================
EPISODE  40
Score of total rewards: 7
===========================================================
EPISODE  41
Score of total rewards: 8
===========================================================
EPISODE  42
Score of total rewards: 5
===========================================================
EPISODE  43
Score of total rewards: 8
===========================================================
EPISODE  44
Score of total rewards: 4
===========================================================
EPISODE  45
Score of total rewards: 6
===========================================================
EPISODE  46
Score of total rewards: 8
===========================================================
EPISODE  47
Score of total rewards: 7
===========================================================
EPISODE  48
Score of total rewards: 10
===========================================================
EPISODE  49
Score of total rewards: 11
===========================================================
EPISODE  50
Score of total rewards: 4
===========================================================
EPISODE  51
Score of total rewards: 6
===========================================================
EPISODE  52
Score of total rewards: 11
===========================================================
EPISODE  53
Score of total rewards: 11
===========================================================
EPISODE  54
Score of total rewards: 7
===========================================================
EPISODE  55
Score of total rewards: 4
===========================================================
EPISODE  56
Score of total rewards: 5
===========================================================
EPISODE  57
Score of total rewards: 6
===========================================================
EPISODE  58
```

```
Score of total rewards: 4
=========================================================
EPISODE  59
Score of total rewards: 13
=========================================================
EPISODE  60
Score of total rewards: 12
=========================================================
EPISODE  61
Score of total rewards: 7
=========================================================
EPISODE  62
Score of total rewards: 11
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EPISODE  902
Score of total rewards: 10
============================================================
EPISODE  903
Score of total rewards: 8
============================================================
EPISODE  904
Score of total rewards: 4
============================================================
EPISODE  905
Score of total rewards: 12
============================================================
EPISODE  906
Score of total rewards: 10
============================================================
EPISODE  907
Score of total rewards: 7
============================================================
EPISODE  908
Score of total rewards: 8
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EPISODE  909
Score of total rewards: 7
============================================================
EPISODE  910
Score of total rewards: 9
============================================================
EPISODE  911
Score of total rewards: 8
============================================================
EPISODE  912
Score of total rewards: 9
============================================================
EPISODE  913
```

```
Score of total rewards: 10
========================================================
EPISODE  914
Score of total rewards: 13
========================================================
EPISODE  915
Score of total rewards: 8
========================================================
EPISODE  916
Score of total rewards: 9
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EPISODE  917
Score of total rewards: 6
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EPISODE  918
Score of total rewards: 7
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EPISODE  919
Score of total rewards: 5
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EPISODE  920
Score of total rewards: 4
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EPISODE  921
Score of total rewards: 9
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EPISODE  922
Score of total rewards: 5
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EPISODE  923
Score of total rewards: 9
========================================================
EPISODE  924
Score of total rewards: 6
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EPISODE  925
Score of total rewards: 11
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EPISODE  926
Score of total rewards: 8
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EPISODE  927
Score of total rewards: 7
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EPISODE  928
Score of total rewards: 6
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EPISODE  929
Score of total rewards: 7
========================================================
EPISODE  930
Score of total rewards: 6
========================================================
EPISODE  931
Score of total rewards: 7
========================================================
EPISODE  932
```

```
Score of total rewards: 4
============================================================
EPISODE  933
Score of total rewards: 5
============================================================
EPISODE  934
Score of total rewards: 12
============================================================
EPISODE  935
Score of total rewards: 8
============================================================
EPISODE  936
Score of total rewards: 10
============================================================
EPISODE  937
Score of total rewards: 7
============================================================
EPISODE  938
Score of total rewards: 11
============================================================
EPISODE  939
Score of total rewards: 10
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EPISODE  940
Score of total rewards: 7
============================================================
EPISODE  941
Score of total rewards: 6
============================================================
EPISODE  942
Score of total rewards: 15
============================================================
EPISODE  943
Score of total rewards: 13
============================================================
EPISODE  944
Score of total rewards: 6
============================================================
EPISODE  945
Score of total rewards: 6
============================================================
EPISODE  946
Score of total rewards: 5
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EPISODE  947
Score of total rewards: 9
============================================================
EPISODE  948
Score of total rewards: 3
============================================================
EPISODE  949
Score of total rewards: 7
============================================================
EPISODE  950
Score of total rewards: 7
============================================================
EPISODE  951
```

```
Score of total rewards: 8
========================================================
EPISODE  952
Score of total rewards: 8
========================================================
EPISODE  953
Score of total rewards: 4
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EPISODE  954
Score of total rewards: 8
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EPISODE  955
Score of total rewards: 10
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EPISODE  956
Score of total rewards: 9
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EPISODE  957
Score of total rewards: 11
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EPISODE  958
Score of total rewards: 4
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EPISODE  959
Score of total rewards: 7
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EPISODE  960
Score of total rewards: 4
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EPISODE  961
Score of total rewards: 10
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EPISODE  962
Score of total rewards: 12
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EPISODE  963
Score of total rewards: 4
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EPISODE  964
Score of total rewards: 9
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EPISODE  965
Score of total rewards: 10
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EPISODE  966
Score of total rewards: 12
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EPISODE  967
Score of total rewards: 4
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EPISODE  968
Score of total rewards: 7
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EPISODE  969
Score of total rewards: 7
========================================================
EPISODE  970
```

```
Score of total rewards: 5
===========================================================
EPISODE  971
Score of total rewards: 11
===========================================================
EPISODE  972
Score of total rewards: 6
===========================================================
EPISODE  973
Score of total rewards: 7
===========================================================
EPISODE  974
Score of total rewards: 4
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EPISODE  975
Score of total rewards: 7
===========================================================
EPISODE  976
Score of total rewards: 7
===========================================================
EPISODE  977
Score of total rewards: 12
===========================================================
EPISODE  978
Score of total rewards: 11
===========================================================
EPISODE  979
Score of total rewards: 11
===========================================================
EPISODE  980
Score of total rewards: 12
===========================================================
EPISODE  981
Score of total rewards: 14
===========================================================
EPISODE  982
Score of total rewards: 8
===========================================================
EPISODE  983
Score of total rewards: 4
===========================================================
EPISODE  984
Score of total rewards: 7
===========================================================
EPISODE  985
Score of total rewards: 9
===========================================================
EPISODE  986
Score of total rewards: 9
===========================================================
EPISODE  987
Score of total rewards: 6
===========================================================
EPISODE  988
Score of total rewards: 12
===========================================================
EPISODE  989
```

```
Score of total rewards: 6
========================================================
EPISODE  990
Score of total rewards: 10
========================================================
EPISODE  991
Score of total rewards: 12
========================================================
EPISODE  992
Score of total rewards: 4
========================================================
EPISODE  993
Score of total rewards: 6
========================================================
EPISODE  994
Score of total rewards: 4
========================================================
EPISODE  995
Score of total rewards: 10
========================================================
EPISODE  996
Score of total rewards: 8
========================================================
EPISODE  997
Score of total rewards: 5
========================================================
EPISODE  998
Score of total rewards: 6
========================================================
EPISODE  999
Score of total rewards: 8
Average score over time: 7.902
```

In [131…
```python
# only to have a look of the test play result
my_q_agent_fine_tuned.test(test_episodes=5, display=True)
```

Taxi-v3 | Episode: 4 | Step: 15
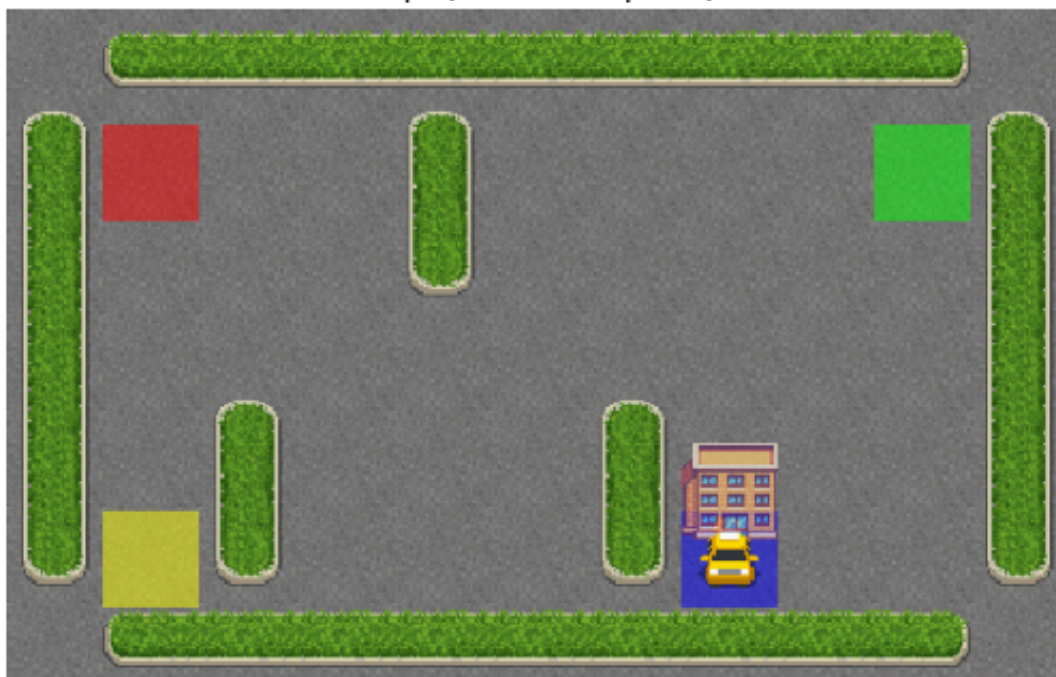
```
Score of total rewards: 6
Average score over time: 8.0
```

`[7, 6, 11, 10, 6]`

Taxi-v3 | Episode: 4 | Step: 15
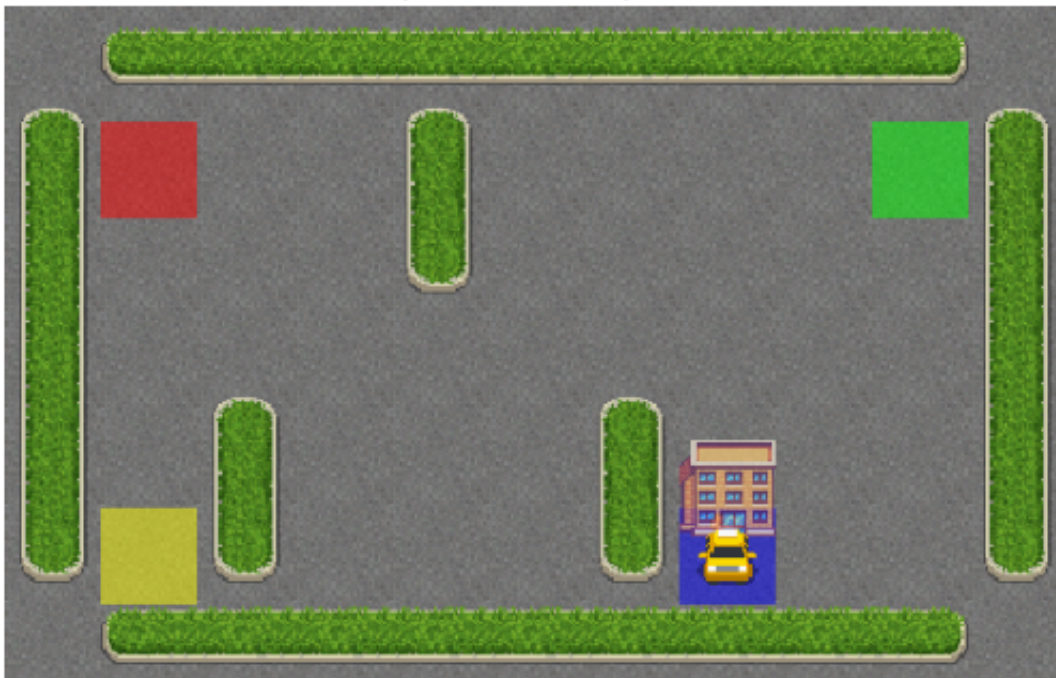
```
# save to GIF
my_q_agent_fine_tuned.test_to_gif(filename="taxi_q_fine_tuned",episodes=5
```

```
episodes: 0, acton: 0, state: 4
episodes: 0, acton: 2, state: 104
episodes: 0, acton: 0, state: 124
episodes: 0, acton: 2, state: 224
episodes: 0, acton: 2, state: 244
episodes: 0, acton: 2, state: 264
episodes: 0, acton: 1, state: 284
episodes: 0, acton: 1, state: 184
episodes: 0, acton: 4, state: 84
episodes: 0, acton: 0, state: 96
episodes: 0, acton: 3, state: 196
episodes: 0, acton: 0, state: 176
episodes: 0, acton: 3, state: 276
episodes: 0, acton: 3, state: 256
episodes: 0, acton: 3, state: 236
episodes: 0, acton: 1, state: 216
episodes: 0, acton: 1, state: 116
episodes: 0, acton: 5, state: 16
episodes: 1, acton: 0, state: 126
episodes: 1, acton: 2, state: 226
episodes: 1, acton: 1, state: 246
episodes: 1, acton: 2, state: 146
episodes: 1, acton: 2, state: 166
episodes: 1, acton: 1, state: 186
episodes: 1, acton: 4, state: 86
episodes: 1, acton: 3, state: 98
episodes: 1, acton: 3, state: 78
episodes: 1, acton: 0, state: 58
episodes: 1, acton: 0, state: 158
```

```
episodes: 1, acton: 3, state: 258
episodes: 1, acton: 3, state: 238
episodes: 1, acton: 0, state: 218
episodes: 1, acton: 0, state: 318
episodes: 1, acton: 5, state: 418
episodes: 2, acton: 0, state: 308
episodes: 2, acton: 4, state: 408
episodes: 2, acton: 1, state: 416
episodes: 2, acton: 1, state: 316
episodes: 2, acton: 1, state: 216
episodes: 2, acton: 1, state: 116
episodes: 2, acton: 5, state: 16
episodes: 3, acton: 0, state: 51
episodes: 3, acton: 0, state: 151
episodes: 3, acton: 3, state: 251
episodes: 3, acton: 3, state: 231
episodes: 3, acton: 0, state: 211
episodes: 3, acton: 0, state: 311
episodes: 3, acton: 4, state: 411
episodes: 3, acton: 1, state: 419
episodes: 3, acton: 1, state: 319
episodes: 3, acton: 2, state: 219
episodes: 3, acton: 2, state: 239
episodes: 3, acton: 2, state: 259
episodes: 3, acton: 0, state: 279
episodes: 3, acton: 0, state: 379
episodes: 3, acton: 5, state: 479
episodes: 4, acton: 0, state: 126
episodes: 4, acton: 2, state: 226
episodes: 4, acton: 1, state: 246
episodes: 4, acton: 2, state: 146
episodes: 4, acton: 2, state: 166
episodes: 4, acton: 1, state: 186
episodes: 4, acton: 4, state: 86
episodes: 4, acton: 3, state: 98
episodes: 4, acton: 3, state: 78
episodes: 4, acton: 0, state: 58
episodes: 4, acton: 0, state: 158
episodes: 4, acton: 3, state: 258
episodes: 4, acton: 3, state: 238
episodes: 4, acton: 0, state: 218
episodes: 4, acton: 0, state: 318
episodes: 4, acton: 5, state: 418
Saving gif...Done!
```

In [135...
```python
# display the captured GIF
display.Image(data=open("./gifs/taxi_q_fine_tuned.gif",'rb').read(), form
# taxi_q_fine_tuned
```

Out[135... `<IPython.core.display.Image object>`

**If the above display function is not working, here is the previously prepared
taxi_q_fine_tuned.gif**
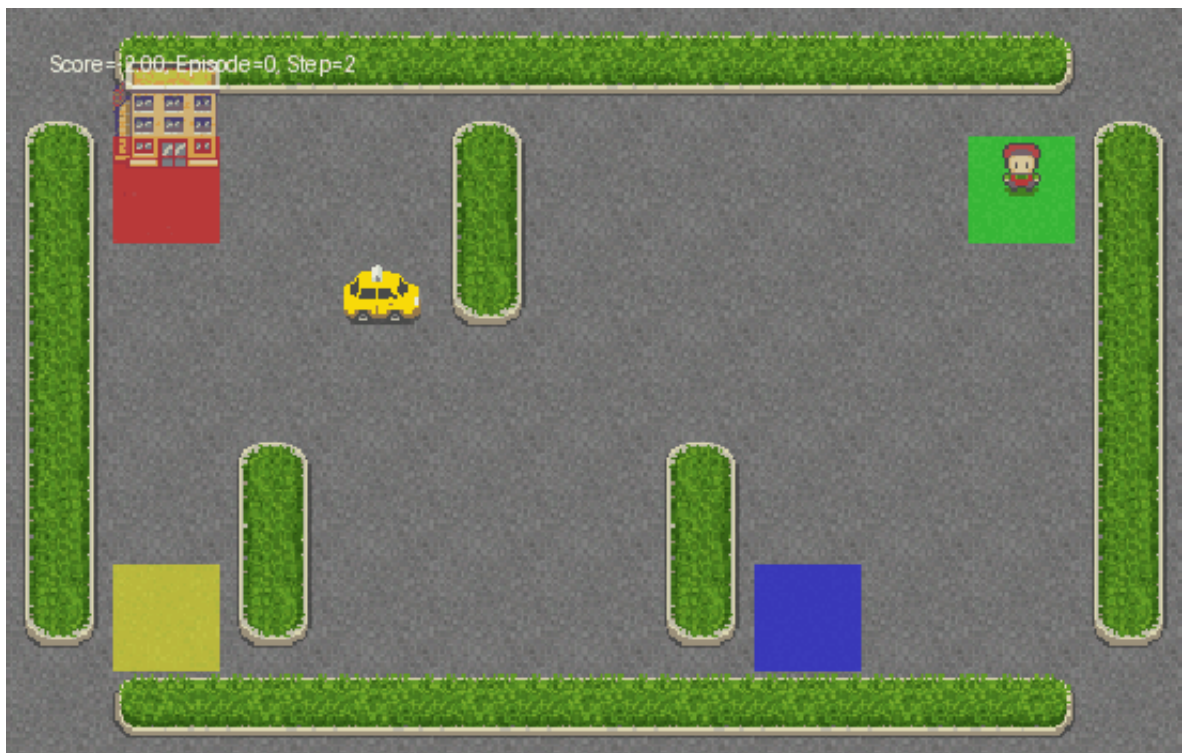
DQN Agent with Fine Tuned Parameters

In [138…

```
%%time
my_dqn_agent_fine_tuned_avg_reward_lst = my_dqn_agent_fine_tuned.test(tes
```

```
/var/folders/dr/jfnhclyj0t1gmk794dvj4zgm0000gn/T/ipykernel_9558/268710954
0.py:221: FutureWarning: You are using `torch.load` with `weights_only=Fal
se` (the current default value), which uses the default pickle module impl
icitly. It is possible to construct malicious pickle data which will execu
te arbitrary code during unpickling (See https://github.com/pytorch/pytorc
h/blob/main/SECURITY.md#untrusted-models for more details). In a future re
lease, the default value for `weights_only` will be flipped to `True`. Thi
s limits the functions that could be executed during unpickling. Arbitrary
objects will no longer be allowed to be loaded via this mode unless they a
re explicitly allowlisted by the user via `torch.serialization.add_safe_gl
obals`. We recommend you start setting `weights_only=True` for any use cas
e where you don't have full control of the loaded file. Please open an iss
ue on GitHub for any issues related to this experimental feature.
  policy_dqn.load_state_dict(torch.load(self.result_model_name + ".pt")) #
"taxi_dql.pt"))
Policy (trained policy network model from the .pt file):
State 000, Action S, Q-values: [+3.28 +3.01 +2.85 +3.27 -4.17 -2.62]
State 001, Action P, Q-values: [+0.17 +0.51 +0.57 +0.64 +1.72 -6.86]
State 002, Action P, Q-values: [+5.46 +5.76 +4.29 +6.53 +7.65 -2.60]
State 003, Action P, Q-values: [+1.27 +1.33 +1.11 +1.69 +3.00 -7.17]
State 004, Action S, Q-values: [-4.84 -5.12 -5.00 -5.37 -14.29 -14.66]
State 005, Action W, Q-values: [+3.10 +3.06 +2.64 +3.19 -4.00 -2.64]
State 006, Action S, Q-values: [-4.83 -5.08 -4.89 -5.14 -14.37 -14.43]
State 007, Action E, Q-values: [-3.05 -3.31 -2.98 -3.39 -9.20 -11.68]
State 008, Action S, Q-values: [+1.77 +0.60 +0.63 +1.38 -8.76 -8.22]
State 009, Action S, Q-values: [-2.45 -2.82 -2.88 -2.80 -10.67 -11.53]
State 010, Action W, Q-values: [+3.19 +3.11 +2.82 +3.23 -4.32 -2.96]
State 011, Action S, Q-values: [-1.67 -1.81 -2.20 -2.27 -10.43 -11.18]
State 012, Action S, Q-values: [-3.88 -4.30 -3.91 -4.65 -11.24 -13.40]
State 013, Action S, Q-values: [-2.29 -2.68 -2.33 -2.46 -10.81 -11.76]
```

```
State 014, Action E, Q-values: [−4.04 −4.19 −3.84 −4.35 −12.32 −13.25]
State 015, Action W, Q-values: [+3.16 +3.09 +2.76 +3.16 −4.39 −2.88]
State 016, Action D, Q-values: [+14.90 +15.38 +13.90 +16.09 +8.30 +20.03]
State 017, Action E, Q-values: [+2.87 +1.35 +2.92 +2.44 −6.18 −0.67]
State 018, Action S, Q-values: [+9.49 +7.12 +5.77 +7.40 −1.43 +4.66]
State 019, Action S, Q-values: [+4.39 +3.10 +4.37 +3.53 −5.63 +0.87]
State 020, Action W, Q-values: [+3.20 +3.10 +2.78 +3.24 −4.06 −2.63]
State 021, Action W, Q-values: [−0.05 −0.26 +0.12 +0.58 −7.31 −7.82]
State 022, Action W, Q-values: [+3.31 +4.42 +3.77 +5.83 −3.53 −4.08]
State 023, Action W, Q-values: [+0.73 +0.77 +1.18 +1.64 −6.70 −7.48]
State 024, Action S, Q-values: [−4.37 −4.66 −4.64 −4.71 −14.45 −14.34]
State 025, Action S, Q-values: [+3.14 +2.87 +2.68 +3.12 −4.41 −2.93]
State 026, Action S, Q-values: [−4.53 −4.81 −5.03 −5.24 −12.72 −13.94]
State 027, Action S, Q-values: [−2.32 −2.90 −2.84 −2.96 −10.37 −11.39]
State 028, Action W, Q-values: [+0.42 −0.34 +0.11 +0.53 −9.63 −10.35]
State 029, Action W, Q-values: [−3.31 −3.59 −3.53 −3.07 −11.48 −13.07]
State 030, Action W, Q-values: [+3.28 +2.94 +2.88 +3.34 −4.26 −2.93]
State 031, Action S, Q-values: [−2.35 −2.46 −3.07 −2.51 −10.72 −11.65]
State 032, Action S, Q-values: [−3.14 −3.29 −3.48 −4.02 −10.94 −12.30]
State 033, Action S, Q-values: [−1.41 −1.79 −1.82 −2.12 −10.04 −10.35]
State 034, Action S, Q-values: [−3.23 −3.47 −3.71 −3.91 −10.62 −12.90]
State 035, Action W, Q-values: [+3.19 +3.05 +2.85 +3.25 −4.48 −2.68]
State 036, Action W, Q-values: [+12.91 +13.86 +13.56 +16.76 +5.14 +6.30]
State 037, Action S, Q-values: [+4.30 +2.61 +3.24 +2.49 −5.90 −5.91]
State 038, Action W, Q-values: [+7.10 +6.05 +5.87 +7.36 −2.65 −1.84]
State 039, Action S, Q-values: [+5.98 +4.72 +4.48 +4.06 −3.63 −3.60]
State 040, Action W, Q-values: [+3.14 +2.86 +2.74 +3.17 −4.34 −2.60]
State 041, Action S, Q-values: [−3.89 −4.33 −4.29 −4.09 −11.28 −13.41]
State 042, Action S, Q-values: [−0.66 −1.75 −2.03 −1.65 −10.78 −10.93]
State 043, Action S, Q-values: [−3.22 −3.46 −3.70 −3.51 −11.22 −12.15]
State 044, Action E, Q-values: [−1.65 −0.89 −0.35 −1.40 −9.95 −10.54]
State 045, Action W, Q-values: [+3.26 +3.09 +2.81 +3.33 −4.21 −2.91]
State 046, Action E, Q-values: [−1.33 −1.10 −0.54 −1.04 −9.22 −10.28]
State 047, Action E, Q-values: [+0.97 +1.60 +3.02 +1.19 −5.03 −7.55]
State 048, Action S, Q-values: [−0.60 −1.20 −1.30 −1.08 −10.14 −10.35]
State 049, Action S, Q-values: [−3.80 −4.12 −4.14 −4.33 −11.31 −12.97]
State 050, Action W, Q-values: [+3.33 +3.26 +2.95 +3.35 −4.49 −2.74]
State 051, Action S, Q-values: [−3.10 −3.82 −3.32 −3.52 −11.87 −12.58]
State 052, Action E, Q-values: [−2.64 −2.82 −2.59 −3.25 −11.71 −11.66]
State 053, Action E, Q-values: [−0.83 −1.28 −0.42 −0.91 −10.03 −10.42]
State 054, Action E, Q-values: [−2.38 −2.70 −2.36 −2.70 −11.20 −11.19]
State 055, Action S, Q-values: [+3.40 +3.18 +2.93 +3.34 −4.27 −2.64]
State 056, Action S, Q-values: [+5.92 +5.03 +4.02 +5.09 −3.35 −3.30]
State 057, Action E, Q-values: [+10.33 +11.85 +14.26 +10.91 +4.55 +4.71]
State 058, Action S, Q-values: [+5.83 +4.86 +3.71 +5.06 −4.08 −3.19]
State 059, Action E, Q-values: [+6.78 +5.84 +7.26 +6.58 −2.72 −1.36]
State 060, Action W, Q-values: [+2.84 +2.71 +2.47 +2.92 −4.69 −3.12]
State 061, Action S, Q-values: [−4.57 −4.79 −4.89 −4.58 −14.14 −14.15]
State 062, Action S, Q-values: [−1.49 −1.97 −2.02 −1.54 −10.21 −11.28]
State 063, Action S, Q-values: [−3.84 −4.22 −4.28 −4.17 −11.58 −13.02]
State 064, Action E, Q-values: [−1.36 −0.23 +0.74 −1.19 −6.77 −8.24]
State 065, Action W, Q-values: [+3.18 +3.10 +2.82 +3.24 −4.27 −2.95]
State 066, Action E, Q-values: [−1.12 +0.13 +0.52 −0.58 −7.91 −6.43]
State 067, Action E, Q-values: [+1.78 +3.11 +4.45 +1.98 −3.57 −4.49]
State 068, Action W, Q-values: [−1.72 −2.07 −2.25 −1.68 −9.42 −10.81]
State 069, Action S, Q-values: [−4.48 −4.74 −5.06 −4.85 −13.59 −14.07]
State 070, Action W, Q-values: [+3.07 +2.92 +2.73 +3.22 −4.11 −2.86]
```

```
State 071, Action S, Q-values: [-3.67 -3.93 -3.75 -3.69 -11.93 -12.63]
State 072, Action S, Q-values: [-1.41 -1.68 -2.02 -2.06 -10.52 -10.72]
State 073, Action S, Q-values: [+0.43 -0.60 -0.65 -0.43 -9.72 -9.27]
State 074, Action S, Q-values: [-1.50 -2.10 -2.25 -2.21 -10.16 -10.79]
State 075, Action W, Q-values: [+3.15 +3.05 +2.78 +3.21 -4.57 -2.87]
State 076, Action S, Q-values: [+4.43 +3.37 +2.63 +4.29 -4.72 -5.19]
State 077, Action E, Q-values: [+11.82 +13.76 +16.95 +11.84 +4.25 +4.90]
State 078, Action S, Q-values: [+4.27 +3.38 +2.18 +4.22 -5.85 -5.90]
State 079, Action S, Q-values: [+9.63 +7.63 +6.29 +6.77 -1.32 -0.44]
State 080, Action S, Q-values: [+3.16 +2.92 +2.75 +3.14 -4.34 -3.00]
State 081, Action W, Q-values: [-5.13 -5.23 -5.37 -5.11 -14.98 -15.32]
State 082, Action S, Q-values: [-2.40 -2.88 -2.89 -2.63 -10.32 -11.89]
State 083, Action S, Q-values: [-4.39 -4.66 -4.47 -4.42 -13.80 -13.51]
State 084, Action P, Q-values: [+0.46 +0.26 +0.79 +0.66 +1.84 -5.96]
State 085, Action W, Q-values: [+3.13 +2.96 +2.82 +3.21 -4.19 -2.78]
State 086, Action P, Q-values: [+0.66 +0.59 +1.13 +0.86 +1.69 -6.19]
State 087, Action P, Q-values: [+3.58 +4.38 +3.99 +3.97 +6.05 -3.02]
State 088, Action W, Q-values: [-2.90 -3.20 -3.22 -2.73 -11.05 -12.46]
State 089, Action W, Q-values: [-5.11 -5.16 -5.07 -5.05 -14.55 -15.10]
State 090, Action W, Q-values: [+3.17 +3.17 +2.90 +3.25 -4.33 -3.04]
State 091, Action W, Q-values: [-4.42 -4.64 -4.59 -4.31 -12.12 -13.83]
State 092, Action W, Q-values: [-2.46 -2.55 -2.66 -2.41 -10.66 -11.40]
State 093, Action W, Q-values: [-0.70 -1.11 -0.79 -0.48 -10.35 -10.19]
State 094, Action S, Q-values: [-2.07 -2.64 -2.50 -2.25 -11.00 -11.23]
State 095, Action W, Q-values: [+3.12 +3.07 +2.80 +3.18 -4.11 -2.87]
State 096, Action S, Q-values: [+2.94 +1.92 +2.00 +2.94 -6.36 -0.98]
State 097, Action D, Q-values: [+14.81 +14.99 +15.37 +14.58 +7.62 +19.94]
State 098, Action S, Q-values: [+2.91 +1.86 +1.81 +2.86 -6.68 -1.94]
State 099, Action S, Q-values: [+7.60 +6.04 +6.10 +7.52 -2.24 +3.22]
State 100, Action W, Q-values: [+3.16 +3.09 +2.81 +3.20 -4.61 -3.08]
State 101, Action N, Q-values: [-0.35 +0.68 -0.98 -0.09 -6.98 -6.63]
State 102, Action N, Q-values: [+3.48 +6.11 +4.04 +5.07 -3.65 -2.88]
State 103, Action N, Q-values: [+0.68 +1.86 +0.11 +0.96 -7.56 -6.81]
State 104, Action E, Q-values: [-4.46 -5.15 -4.35 -4.66 -13.36 -13.92]
State 105, Action W, Q-values: [+3.37 +3.28 +3.05 +3.39 -4.28 -2.51]
State 106, Action E, Q-values: [-4.41 -4.99 -4.38 -4.81 -13.70 -13.85]
State 107, Action E, Q-values: [-2.42 -2.54 -2.42 -2.67 -10.41 -11.12]
State 108, Action S, Q-values: [+2.79 +1.10 +0.98 +1.75 -7.07 -6.63]
State 109, Action S, Q-values: [-1.58 -2.81 -2.49 -2.20 -9.97 -11.05]
State 110, Action W, Q-values: [+3.20 +2.96 +2.81 +3.24 -4.03 -2.58]
State 111, Action S, Q-values: [-0.68 -1.40 -1.44 -1.23 -10.04 -10.03]
State 112, Action S, Q-values: [-3.11 -3.26 -3.16 -3.40 -10.95 -11.66]
State 113, Action E, Q-values: [-1.65 -2.37 -1.46 -1.88 -10.56 -10.13]
State 114, Action S, Q-values: [-3.25 -3.85 -3.32 -3.76 -11.02 -12.18]
State 115, Action W, Q-values: [+3.34 +3.16 +3.01 +3.37 -3.98 -2.69]
State 116, Action N, Q-values: [+11.94 +17.15 +13.50 +14.09 +5.26 +5.05]
State 117, Action E, Q-values: [+4.24 +2.00 +4.34 +3.05 -6.06 -5.24]
State 118, Action S, Q-values: [+11.80 +8.91 +8.18 +9.64 +0.33 +0.26]
State 119, Action E, Q-values: [+6.00 +3.31 +6.01 +4.91 -4.32 -4.09]
State 120, Action W, Q-values: [+3.14 +3.05 +2.71 +3.26 -4.17 -3.06]
State 121, Action N, Q-values: [-1.19 -0.23 -0.92 -0.36 -8.20 -8.23]
State 122, Action N, Q-values: [+3.02 +4.35 +3.04 +3.58 -5.15 -2.96]
State 123, Action N, Q-values: [-0.14 +0.64 +0.09 +0.51 -8.88 -7.49]
State 124, Action S, Q-values: [-3.90 -4.48 -4.24 -4.77 -12.89 -12.73]
State 125, Action W, Q-values: [+3.27 +3.06 +2.80 +3.32 -3.85 -2.49]
State 126, Action S, Q-values: [-3.77 -4.15 -4.16 -4.24 -11.90 -12.97]
State 127, Action S, Q-values: [-1.29 -2.26 -1.73 -1.66 -10.30 -10.26]
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State 128, Action W, Q-values: [+1.64 +0.46 +0.94 +1.73 −8.72 −9.16]
State 129, Action S, Q-values: [−2.36 −2.87 −2.82 −2.62 −10.24 −10.90]
State 130, Action W, Q-values: [+3.18 +2.99 +2.75 +3.22 −4.06 −2.87]
State 131, Action S, Q-values: [−1.44 −1.98 −1.68 −1.48 −9.91 −10.28]
State 132, Action S, Q-values: [−2.38 −2.91 −2.92 −2.92 −9.59 −10.94]
State 133, Action S, Q-values: [−0.41 −1.00 −0.90 −0.88 −9.55 −9.47]
State 134, Action S, Q-values: [−2.45 −3.03 −2.80 −3.10 −10.73 −11.29]
State 135, Action S, Q-values: [+3.21 +3.00 +2.83 +3.16 −4.12 −2.96]
State 136, Action N, Q-values: [+10.34 +14.31 +12.27 +12.50 +4.29 +3.85]
State 137, Action S, Q-values: [+5.96 +3.33 +4.49 +3.93 −3.71 −4.33]
State 138, Action S, Q-values: [+9.60 +6.93 +7.41 +8.54 −1.40 −2.57]
State 139, Action S, Q-values: [+7.70 +4.96 +5.69 +5.29 −2.22 −2.54]
State 140, Action W, Q-values: [+3.25 +3.07 +2.82 +3.27 −4.41 −3.12]
State 141, Action S, Q-values: [−3.06 −3.72 −3.60 −3.60 −9.83 −11.03]
State 142, Action S, Q-values: [+0.29 −0.68 −1.04 −0.21 −8.25 −9.18]
State 143, Action S, Q-values: [−2.38 −3.54 −3.36 −3.09 −9.96 −11.28]
State 144, Action N, Q-values: [−2.62 −1.22 −1.42 −2.26 −10.21 −9.89]
State 145, Action W, Q-values: [+3.32 +3.23 +2.97 +3.34 −4.26 −3.01]
State 146, Action N, Q-values: [−2.99 −1.42 −1.75 −2.74 −10.20 −10.59]
State 147, Action N, Q-values: [−0.12 +1.82 +1.72 +0.03 −7.96 −7.50]
State 148, Action S, Q-values: [+0.40 −0.71 −0.94 −0.36 −8.44 −8.67]
State 149, Action S, Q-values: [−2.95 −3.90 −3.57 −3.31 −9.06 −10.67]
State 150, Action W, Q-values: [+3.31 +3.12 +2.91 +3.33 −4.42 −2.96]
State 151, Action S, Q-values: [−2.43 −3.10 −2.99 −2.93 −11.06 −11.68]
State 152, Action E, Q-values: [−1.86 −2.28 −1.55 −1.93 −10.25 −10.98]
State 153, Action S, Q-values: [+0.32 −0.69 +0.07 +0.12 −9.30 −9.10]
State 154, Action S, Q-values: [−1.54 −2.03 −1.64 −1.82 −10.24 −10.44]
State 155, Action W, Q-values: [+3.34 +3.19 +2.84 +3.36 −4.26 −2.60]
State 156, Action S, Q-values: [+7.90 +5.48 +4.84 +6.53 −2.02 −1.98]
State 157, Action N, Q-values: [+8.39 +12.10 +11.91 +9.10 +1.88 +1.43]
State 158, Action S, Q-values: [+7.60 +4.78 +4.45 +6.08 −3.07 −2.78]
State 159, Action E, Q-values: [+8.74 +6.61 +9.51 +8.21 −0.60 +1.70]
State 160, Action W, Q-values: [+3.26 +3.15 +2.90 +3.32 −4.12 −2.64]
State 161, Action S, Q-values: [−3.79 −4.77 −4.26 −3.81 −11.65 −13.47]
State 162, Action S, Q-values: [−0.74 −1.64 −1.62 −0.83 −8.87 −10.44]
State 163, Action S, Q-values: [−3.16 −3.64 −3.86 −3.27 −11.22 −12.34]
State 164, Action N, Q-values: [−1.91 −0.31 −0.36 −1.75 −8.93 −8.36]
State 165, Action W, Q-values: [+3.21 +3.01 +2.84 +3.27 −4.12 −2.56]
State 166, Action N, Q-values: [−2.14 −0.38 −0.75 −2.09 −9.99 −10.44]
State 167, Action N, Q-values: [+1.15 +3.16 +2.78 +1.11 −5.76 −3.74]
State 168, Action S, Q-values: [−0.59 −1.49 −1.31 −0.71 −9.30 −9.99]
State 169, Action S, Q-values: [−3.83 −4.19 −4.04 −3.84 −12.08 −12.26]
State 170, Action S, Q-values: [+3.15 +2.88 +2.60 +3.11 −4.43 −3.03]
State 171, Action S, Q-values: [−3.14 −3.52 −3.71 −3.14 −10.46 −11.74]
State 172, Action S, Q-values: [−0.45 −1.28 −1.69 −1.48 −9.51 −9.64]
State 173, Action S, Q-values: [+1.67 +0.38 +0.10 +0.32 −7.95 −7.46]
State 174, Action S, Q-values: [−0.65 −1.87 −1.73 −1.62 −9.91 −10.06]
State 175, Action W, Q-values: [+3.05 +3.03 +2.78 +3.13 −4.31 −3.10]
State 176, Action S, Q-values: [+5.94 +3.87 +4.28 +5.84 −4.16 −3.92]
State 177, Action N, Q-values: [+10.55 +14.43 +14.15 +10.54 +4.42 +4.91]
State 178, Action S, Q-values: [+5.83 +3.89 +3.71 +5.80 −3.92 −4.26]
State 179, Action S, Q-values: [+11.71 +8.43 +7.63 +8.65 +0.12 +1.38]
State 180, Action W, Q-values: [+3.08 +3.11 +2.71 +3.28 −4.28 −2.98]
State 181, Action S, Q-values: [−4.30 −4.37 −4.43 −4.42 −13.65 −13.64]
State 182, Action W, Q-values: [−1.52 −1.91 −1.80 −1.51 −10.74 −10.98]
State 183, Action S, Q-values: [−3.73 −4.45 −4.28 −4.03 −11.91 −12.87]
State 184, Action N, Q-values: [−0.98 +0.82 −0.56 −0.18 −8.68 −8.32]
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State 185, Action W, Q-values: [+3.20 +3.09 +2.81 +3.22 −4.31 −2.91]
State 186, Action N, Q-values: [−0.64 +0.60 −0.24 −1.08 −7.38 −6.54]
State 187, Action N, Q-values: [+2.03 +4.68 +3.67 +2.03 −3.93 −4.20]
State 188, Action S, Q-values: [−1.42 −2.14 −1.72 −1.61 −10.27 −11.23]
State 189, Action S, Q-values: [−4.33 −4.65 −4.52 −4.36 −12.80 −13.53]
State 190, Action W, Q-values: [+3.35 +3.27 +2.94 +3.40 −3.98 −2.32]
State 191, Action S, Q-values: [−3.76 −4.11 −3.97 −3.82 −11.74 −12.76]
State 192, Action S, Q-values: [−1.43 −2.00 −1.74 −1.52 −10.36 −10.93]
State 193, Action W, Q-values: [+0.48 −0.61 −0.14 +0.52 −9.45 −9.79]
State 194, Action S, Q-values: [−1.62 −2.04 −1.91 −1.65 −9.93 −10.49]
State 195, Action W, Q-values: [+2.99 +2.74 +2.58 +3.02 −4.63 −3.13]
State 196, Action W, Q-values: [+4.36 +2.56 +3.34 +4.42 −5.82 −5.63]
State 197, Action N, Q-values: [+12.06 +17.16 +14.74 +13.00 +5.49 +6.10]
State 198, Action S, Q-values: [+4.43 +2.16 +3.31 +4.30 −5.23 −6.26]
State 199, Action W, Q-values: [+9.46 +6.83 +7.55 +9.51 −1.04 −1.12]
State 200, Action W, Q-values: [+3.15 +3.12 +2.84 +3.26 −4.25 −2.97]
State 201, Action N, Q-values: [−1.27 −0.33 −1.30 −1.11 −8.92 −8.61]
State 202, Action N, Q-values: [+2.30 +4.62 +1.77 +3.60 −4.28 −4.93]
State 203, Action N, Q-values: [−0.69 +0.71 −1.31 −0.16 −8.33 −7.93]
State 204, Action E, Q-values: [−4.10 −3.91 −3.70 −4.14 −10.32 −12.18]
State 205, Action S, Q-values: [+3.09 +2.90 +2.66 +3.07 −4.41 −2.83]
State 206, Action E, Q-values: [−4.53 −4.84 −3.74 −4.29 −12.88 −13.39]
State 207, Action E, Q-values: [−2.19 −2.30 −1.19 −1.84 −10.30 −10.77]
State 208, Action S, Q-values: [+4.07 +1.73 +1.85 +2.85 −6.04 −6.07]
State 209, Action S, Q-values: [−0.49 −2.02 −1.67 −1.14 −8.94 −9.70]
State 210, Action W, Q-values: [+3.46 +3.33 +3.09 +3.53 −3.90 −2.57]
State 211, Action S, Q-values: [+0.49 −0.85 −0.74 −0.31 −8.28 −8.07]
State 212, Action E, Q-values: [−2.85 −3.15 −2.32 −2.52 −10.65 −11.63]
State 213, Action E, Q-values: [−1.87 −1.39 −0.53 −1.67 −10.68 −11.05]
State 214, Action E, Q-values: [−3.18 −3.07 −2.37 −3.08 −11.11 −11.68]
State 215, Action W, Q-values: [+3.07 +2.93 +2.64 +3.08 −4.40 −3.29]
State 216, Action N, Q-values: [+9.53 +14.32 +10.48 +11.42 +3.87 +3.33]
State 217, Action E, Q-values: [+3.58 +4.17 +6.11 +4.37 −3.82 −3.48]
State 218, Action S, Q-values: [+14.35 +9.56 +9.38 +11.70 +2.37 +3.99]
State 219, Action E, Q-values: [+4.85 +4.55 +7.74 +5.56 −1.59 −3.12]
State 220, Action W, Q-values: [+3.33 +3.22 +3.01 +3.42 −4.16 −2.43]
State 221, Action N, Q-values: [−2.68 −1.29 −2.53 −1.41 −8.71 −9.88]
State 222, Action N, Q-values: [+1.08 +3.04 +1.03 +2.90 −7.24 −6.37]
State 223, Action N, Q-values: [−1.89 −0.35 −1.79 −0.48 −9.38 −8.94]
State 224, Action E, Q-values: [−3.75 −3.64 −3.01 −3.63 −9.71 −11.80]
State 225, Action W, Q-values: [+2.88 +2.86 +2.66 +3.02 −4.29 −3.01]
State 226, Action E, Q-values: [−3.69 −3.43 −3.06 −3.53 −10.72 −11.67]
State 227, Action E, Q-values: [−1.85 −1.37 −0.44 −1.67 −8.68 −9.06]
State 228, Action W, Q-values: [+0.99 +0.92 +0.39 +2.84 −6.80 −8.08]
State 229, Action W, Q-values: [−2.01 −2.52 −2.03 −1.51 −8.62 −9.72]
State 230, Action W, Q-values: [+3.32 +3.19 +2.95 +3.35 −4.16 −2.39]
State 231, Action W, Q-values: [−1.62 −1.59 −1.57 −0.54 −8.28 −9.68]
State 232, Action E, Q-values: [−2.83 −2.78 −1.50 −2.72 −10.06 −11.05]
State 233, Action E, Q-values: [−1.21 −0.94 +0.64 −1.37 −9.58 −10.12]
State 234, Action E, Q-values: [−2.77 −2.26 −1.53 −2.69 −10.12 −10.39]
State 235, Action W, Q-values: [+3.26 +3.17 +2.80 +3.30 −4.48 −2.82]
State 236, Action N, Q-values: [+8.09 +11.76 +8.04 +11.58 +1.13 +1.01]
State 237, Action E, Q-values: [+4.80 +4.98 +7.88 +4.73 −0.96 −1.25]
State 238, Action W, Q-values: [+8.96 +8.65 +8.51 +11.82 +0.95 −0.90]
State 239, Action E, Q-values: [+5.64 +6.64 +9.61 +5.68 −1.19 −1.24]
State 240, Action S, Q-values: [+3.41 +3.15 +2.95 +3.40 −4.06 −2.64]
State 241, Action W, Q-values: [−2.85 −2.80 −3.08 −2.34 −9.68 −10.59]
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State 242, Action W, Q-values: [−0.03 −0.20 −0.12 +1.48 −7.43 −9.57]
State 243, Action W, Q-values: [−2.02 −1.98 −1.97 −1.39 −9.09 −9.37]
State 244, Action N, Q-values: [−3.48 −2.18 −2.20 −3.19 −9.93 −9.88]
State 245, Action W, Q-values: [+3.18 +2.92 +2.80 +3.26 −4.06 −2.67]
State 246, Action N, Q-values: [−3.62 −2.24 −2.28 −3.31 −10.04 −10.23]
State 247, Action N, Q-values: [−1.41 +0.56 +0.55 −1.34 −8.36 −7.99]
State 248, Action W, Q-values: [+0.91 −0.22 +0.37 +1.62 −7.96 −8.75]
State 249, Action W, Q-values: [−3.07 −3.26 −2.90 −2.30 −10.94 −11.90]
State 250, Action W, Q-values: [+3.40 +3.31 +3.04 +3.50 −4.01 −2.45]
State 251, Action W, Q-values: [−2.26 −2.54 −2.23 −1.50 −10.50 −10.88]
State 252, Action E, Q-values: [−1.98 −1.56 −0.52 −1.86 −8.87 −9.71]
State 253, Action E, Q-values: [+0.23 +0.19 +1.76 +0.51 −7.58 −6.61]
State 254, Action E, Q-values: [−1.91 −1.62 −0.52 −1.61 −8.40 −9.57]
State 255, Action W, Q-values: [+2.99 +2.95 +2.64 +3.06 −4.71 −3.08]
State 256, Action W, Q-values: [+6.35 +6.77 +6.42 +9.72 +0.34 −1.21]
State 257, Action N, Q-values: [+6.46 +9.96 +9.76 +6.33 +0.74 +0.60]
State 258, Action W, Q-values: [+6.31 +6.24 +6.03 +9.50 −0.80 −0.95]
State 259, Action E, Q-values: [+7.87 +8.42 +11.80 +7.80 +1.56 +1.81]
State 260, Action W, Q-values: [+3.32 +3.11 +2.92 +3.42 −4.27 −2.65]
State 261, Action W, Q-values: [−3.96 −4.04 −3.73 −3.11 −11.80 −12.12]
State 262, Action W, Q-values: [−1.22 −0.77 −1.18 +0.25 −9.08 −10.25]
State 263, Action W, Q-values: [−2.88 −2.70 −2.80 −2.33 −10.17 −11.51]
State 264, Action N, Q-values: [−2.94 −1.28 −1.36 −2.79 −9.75 −9.69]
State 265, Action S, Q-values: [+3.42 +3.03 +2.93 +3.38 −4.24 −2.66]
State 266, Action N, Q-values: [−2.94 −1.41 −1.45 −2.55 −9.17 −9.72]
State 267, Action N, Q-values: [−0.59 +1.83 +1.69 −0.34 −8.07 −6.99]
State 268, Action W, Q-values: [−1.05 −1.32 −1.20 +0.37 −9.26 −10.28]
State 269, Action W, Q-values: [−3.88 −3.98 −3.96 −3.03 −12.39 −13.17]
State 270, Action S, Q-values: [+3.24 +3.02 +2.88 +3.23 −4.43 −2.77]
State 271, Action W, Q-values: [−2.99 −2.88 −2.92 −2.41 −11.03 −11.50]
State 272, Action S, Q-values: [+0.49 −1.02 −1.00 −0.38 −9.28 −9.43]
State 273, Action S, Q-values: [+2.85 +0.39 +0.63 +0.72 −6.89 −6.66]
State 274, Action S, Q-values: [+0.53 −0.83 −1.26 −1.12 −9.03 −7.48]
State 275, Action W, Q-values: [+3.41 +3.21 +2.96 +3.44 −4.29 −2.66]
State 276, Action W, Q-values: [+4.25 +6.04 +4.08 +7.77 −1.93 −3.19]
State 277, Action N, Q-values: [+8.16 +12.03 +11.74 +8.38 +2.04 +1.31]
State 278, Action W, Q-values: [+4.80 +4.60 +4.47 +7.63 −1.51 −2.37]
State 279, Action S, Q-values: [+14.23 +9.41 +9.49 +10.75 +2.31 +4.74]
State 280, Action W, Q-values: [+3.24 +3.04 +2.87 +3.29 −4.27 −2.60]
State 281, Action W, Q-values: [−4.23 −4.07 −3.95 −3.80 −12.81 −13.30]
State 282, Action W, Q-values: [−1.16 −1.88 −0.92 −0.37 −9.69 −11.01]
State 283, Action W, Q-values: [−3.65 −3.84 −3.52 −3.19 −10.82 −12.65]
State 284, Action N, Q-values: [−1.59 −0.22 −1.14 −2.05 −9.37 −9.43]
State 285, Action W, Q-values: [+3.21 +3.10 +2.83 +3.24 −4.16 −2.83]
State 286, Action N, Q-values: [−1.79 −0.48 −1.58 −2.21 −9.58 −8.44]
State 287, Action N, Q-values: [+1.70 +3.19 +2.00 +0.98 −6.50 −6.86]
State 288, Action W, Q-values: [−1.12 −1.14 −0.75 −0.43 −10.01 −10.10]
State 289, Action W, Q-values: [−4.35 −4.06 −4.30 −3.80 −12.59 −13.82]
State 290, Action W, Q-values: [+3.24 +3.10 +2.92 +3.33 −4.16 −2.43]
State 291, Action W, Q-values: [−3.66 −3.74 −3.78 −3.39 −12.09 −12.96]
State 292, Action W, Q-values: [−0.70 −1.55 −1.06 −0.58 −9.85 −10.17]
State 293, Action S, Q-values: [+1.61 +0.16 +0.78 +1.43 −8.83 −8.47]
State 294, Action S, Q-values: [−0.48 −1.12 −0.95 −0.60 −9.14 −9.92]
State 295, Action W, Q-values: [+3.25 +3.09 +2.95 +3.27 −4.12 −2.67]
State 296, Action W, Q-values: [+3.31 +4.03 +3.96 +5.99 −3.45 −4.69]
State 297, Action N, Q-values: [+10.19 +14.45 +12.02 +10.96 +4.37 +4.65]
State 298, Action W, Q-values: [+3.48 +3.88 +4.25 +5.97 −3.31 −4.59]
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State 299, Action S, Q-values: [+11.66 +8.77 +9.30 +10.89 +0.36 −0.32]
State 300, Action W, Q-values: [+3.31 +3.12 +2.93 +3.37 −3.92 −2.30]
State 301, Action N, Q-values: [−2.40 −1.31 −2.18 −2.13 −10.70 −10.09]
State 302, Action N, Q-values: [+2.17 +3.18 +2.09 +1.73 −7.53 −7.04]
State 303, Action N, Q-values: [−1.40 −0.29 −1.09 −1.04 −10.55 −10.25]
State 304, Action N, Q-values: [−4.69 −4.35 −4.71 −4.74 −12.42 −13.51]
State 305, Action W, Q-values: [+3.21 +3.05 +2.78 +3.27 −4.17 −2.46]
State 306, Action N, Q-values: [−5.91 −4.18 −5.12 −5.12 −15.82 −16.47]
State 307, Action N, Q-values: [−3.19 −2.08 −2.84 −2.82 −10.15 −10.83]
State 308, Action S, Q-values: [+5.65 +3.67 +4.32 +4.64 −3.94 −3.72]
State 309, Action S, Q-values: [+0.51 −0.97 +0.17 +0.09 −9.41 −8.22]
State 310, Action W, Q-values: [+3.26 +3.15 +2.89 +3.34 −4.26 −2.96]
State 311, Action S, Q-values: [+1.60 +0.47 +0.80 +0.91 −6.18 −6.87]
State 312, Action N, Q-values: [−4.30 −2.98 −3.78 −3.94 −12.15 −12.25]
State 313, Action N, Q-values: [−2.53 −1.47 −2.01 −2.18 −10.41 −10.29]
State 314, Action N, Q-values: [−4.31 −3.02 −3.79 −3.72 −12.44 −12.10]
State 315, Action W, Q-values: [+3.26 +3.22 +2.99 +3.38 −4.43 −2.96]
State 316, Action N, Q-values: [+8.07 +11.95 +9.60 +9.28 +3.66 +2.92]
State 317, Action N, Q-values: [+1.58 +4.53 +4.05 +2.28 −5.47 −5.40]
State 318, Action S, Q-values: [+17.00 +11.69 +13.48 +14.45 +5.07 +7.45]
State 319, Action N, Q-values: [+3.20 +6.24 +4.83 +4.33 −3.75 −3.18]
State 320, Action W, Q-values: [+3.17 +3.05 +2.88 +3.23 −4.23 −2.73]
State 321, Action N, Q-values: [−3.30 −2.09 −3.18 −2.94 −10.65 −11.29]
State 322, Action N, Q-values: [+0.30 +1.65 +0.16 +0.99 −8.18 −8.77]
State 323, Action N, Q-values: [−2.39 −1.30 −2.43 −2.19 −9.95 −10.09]
State 324, Action N, Q-values: [−4.04 −3.61 −3.63 −4.08 −12.29 −12.37]
State 325, Action S, Q-values: [+3.36 +3.24 +2.92 +3.34 −4.18 −2.74]
State 326, Action E, Q-values: [−4.03 −3.72 −3.61 −4.21 −12.99 −13.00]
State 327, Action N, Q-values: [−2.61 −1.45 −1.97 −2.18 −10.17 −10.79]
State 328, Action N, Q-values: [+0.57 +1.68 +0.35 +1.00 −9.07 −8.83]
State 329, Action N, Q-values: [−3.35 −2.20 −3.27 −3.05 −8.96 −11.17]
State 330, Action W, Q-values: [+2.94 +2.80 +2.58 +2.99 −4.41 −3.23]
State 331, Action N, Q-values: [−2.37 −1.35 −2.18 −1.97 −9.65 −9.67]
State 332, Action N, Q-values: [−2.66 −2.18 −2.24 −2.69 −10.06 −10.60]
State 333, Action N, Q-values: [−1.94 −0.45 −0.47 −1.40 −10.24 −9.87]
State 334, Action N, Q-values: [−3.50 −2.28 −2.69 −2.97 −11.27 −11.57]
State 335, Action S, Q-values: [+3.23 +3.10 +2.79 +3.20 −4.49 −2.70]
State 336, Action N, Q-values: [+6.53 +9.96 +6.59 +8.95 +0.92 +0.21]
State 337, Action N, Q-values: [+3.89 +6.22 +5.46 +4.28 −4.37 −2.39]
State 338, Action N, Q-values: [+6.71 +9.43 +6.87 +8.06 −0.55 +0.45]
State 339, Action N, Q-values: [+5.44 +7.71 +7.07 +5.97 −2.70 −0.55]
State 340, Action W, Q-values: [+3.24 +2.96 +2.86 +3.24 −4.16 −2.93]
State 341, Action N, Q-values: [−3.44 −2.96 −3.46 −3.17 −10.32 −11.60]
State 342, Action N, Q-values: [−0.39 +0.62 −0.09 +0.45 −9.71 −8.94]
State 343, Action N, Q-values: [−3.32 −2.13 −2.79 −2.25 −11.24 −11.40]
State 344, Action N, Q-values: [−4.07 −2.87 −3.59 −3.90 −11.24 −11.66]
State 345, Action S, Q-values: [+3.22 +2.97 +2.78 +3.19 −4.16 −2.62]
State 346, Action N, Q-values: [−4.22 −3.02 −3.58 −3.88 −11.53 −11.49]
State 347, Action N, Q-values: [−1.81 −0.24 −1.06 −2.01 −9.91 −10.24]
State 348, Action N, Q-values: [−0.94 +0.35 −0.57 +0.03 −9.55 −9.51]
State 349, Action N, Q-values: [−4.11 −2.91 −3.66 −3.11 −11.28 −11.08]
State 350, Action S, Q-values: [+3.24 +2.93 +2.72 +3.18 −4.10 −2.87]
State 351, Action N, Q-values: [−3.38 −2.17 −3.00 −2.78 −11.51 −11.20]
State 352, Action N, Q-values: [−2.54 −1.35 −2.13 −2.44 −9.99 −10.12]
State 353, Action N, Q-values: [−0.37 +0.70 +0.01 −0.81 −8.56 −8.58]
State 354, Action N, Q-values: [−2.63 −1.41 −2.12 −2.39 −9.87 −10.34]
State 355, Action W, Q-values: [+3.28 +3.14 +2.85 +3.30 −4.31 −2.74]
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State 356, Action W, Q-values: [+5.79 +7.40 +5.73 +7.86 −1.92 −2.26]
State 357, Action N, Q-values: [+5.17 +7.17 +6.10 +4.94 −2.36 −1.65]
State 358, Action N, Q-values: [+5.12 +7.38 +5.64 +6.78 −2.88 −1.49]
State 359, Action N, Q-values: [+6.84 +9.39 +8.24 +7.01 +0.10 +0.89]
State 360, Action W, Q-values: [+2.92 +2.79 +2.51 +2.98 −4.50 −3.05]
State 361, Action N, Q-values: [−5.07 −3.57 −4.57 −4.47 −13.98 −14.04]
State 362, Action N, Q-values: [−1.40 −0.40 −1.24 −1.10 −9.78 −9.50]
State 363, Action N, Q-values: [−4.12 −2.90 −3.70 −3.73 −12.02 −11.56]
State 364, Action N, Q-values: [−3.26 −2.10 −2.54 −2.74 −11.16 −11.12]
State 365, Action W, Q-values: [+3.39 +3.34 +3.03 +3.44 −4.21 −2.69]
State 366, Action E, Q-values: [−2.39 −2.22 −2.21 −2.40 −9.82 −10.52]
State 367, Action N, Q-values: [−0.62 +0.78 +0.57 −0.34 −10.32 −8.97]
State 368, Action N, Q-values: [−1.39 −0.34 −1.29 −0.99 −9.21 −9.02]
State 369, Action N, Q-values: [−5.03 −3.62 −4.53 −4.49 −13.19 −13.53]
State 370, Action W, Q-values: [+3.25 +3.16 +2.86 +3.28 −4.27 −2.84]
State 371, Action N, Q-values: [−4.39 −3.04 −3.95 −3.78 −12.44 −12.38]
State 372, Action S, Q-values: [+1.48 +0.37 +0.28 +0.88 −6.52 −6.26]
State 373, Action S, Q-values: [+4.20 +2.33 +2.31 +3.03 −5.48 −5.23]
State 374, Action S, Q-values: [+1.61 +0.29 −0.21 +0.78 −6.77 −7.57]
State 375, Action W, Q-values: [+3.30 +3.11 +2.94 +3.31 −4.37 −2.62]
State 376, Action N, Q-values: [+2.83 +6.24 +3.82 +4.56 −2.51 −3.60]
State 377, Action N, Q-values: [+6.85 +10.01 +9.70 +7.36 +0.87 +0.87]
State 378, Action N, Q-values: [+3.12 +6.19 +3.97 +4.52 −1.63 −3.01]
State 379, Action S, Q-values: [+16.86 +11.83 +11.59 +14.13 +4.44 +7.53]
State 380, Action W, Q-values: [+3.31 +3.17 +2.97 +3.36 −4.27 −2.34]
State 381, Action N, Q-values: [−5.11 −4.29 −5.07 −4.71 −13.95 −14.93]
State 382, Action N, Q-values: [−1.82 −1.44 −1.83 −1.55 −10.01 −11.07]
State 383, Action N, Q-values: [−4.80 −3.73 −4.63 −4.50 −13.00 −13.90]
State 384, Action N, Q-values: [−2.52 −1.30 −2.01 −2.53 −10.94 −10.98]
State 385, Action S, Q-values: [+2.97 +2.79 +2.55 +2.95 −4.49 −3.27]
State 386, Action N, Q-values: [−2.49 −1.39 −2.22 −2.67 −10.76 −10.51]
State 387, Action N, Q-values: [+0.30 +1.81 +0.81 −0.34 −8.48 −7.36]
State 388, Action N, Q-values: [−2.56 −1.42 −2.16 −1.53 −10.31 −10.94]
State 389, Action W, Q-values: [−4.95 −4.46 −4.68 −4.45 −14.24 −14.44]
State 390, Action W, Q-values: [+3.09 +2.92 +2.69 +3.16 −4.50 −3.19]
State 391, Action N, Q-values: [−4.12 −3.80 −4.25 −3.93 −11.45 −12.47]
State 392, Action W, Q-values: [+0.52 −0.85 −0.21 +0.59 −8.50 −9.45]
State 393, Action W, Q-values: [+2.83 +1.05 +2.43 +2.84 −7.29 −7.72]
State 394, Action W, Q-values: [+0.48 −0.61 −0.06 +0.55 −8.52 −9.49]
State 395, Action W, Q-values: [+3.00 +2.94 +2.69 +3.04 −4.32 −3.12]
State 396, Action W, Q-values: [+3.19 +4.04 +3.33 +4.42 −5.32 −5.35]
State 397, Action N, Q-values: [+8.07 +12.01 +9.76 +8.92 +3.78 +3.63]
State 398, Action N, Q-values: [+2.85 +4.45 +3.10 +3.68 −6.08 −4.48]
State 399, Action S, Q-values: [+14.18 +9.82 +11.34 +13.28 +2.69 +3.27]
State 400, Action W, Q-values: [+3.19 +2.97 +2.84 +3.25 −4.38 −3.28]
State 401, Action N, Q-values: [−2.55 −2.28 −2.61 −2.69 −10.51 −11.25]
State 402, Action N, Q-values: [+0.57 +1.52 +0.55 +0.58 −8.87 −8.43]
State 403, Action N, Q-values: [−2.31 −1.49 −2.13 −2.02 −10.77 −11.69]
State 404, Action N, Q-values: [−5.29 −4.79 −5.20 −5.24 −14.50 −15.63]
State 405, Action W, Q-values: [+3.19 +3.07 +2.87 +3.27 −4.17 −3.15]
State 406, Action N, Q-values: [−5.51 −4.80 −5.43 −5.66 −15.57 −16.00]
State 407, Action N, Q-values: [−3.55 −2.96 −3.59 −3.78 −11.07 −11.58]
State 408, Action P, Q-values: [+5.86 +5.24 +5.00 +6.06 +7.58 −2.99]
State 409, Action P, Q-values: [+0.65 −0.25 +0.82 +0.71 +1.66 −6.32]
State 410, Action W, Q-values: [+3.21 +2.98 +2.77 +3.21 −4.39 −3.06]
State 411, Action P, Q-values: [+2.03 +0.61 +1.78 +1.83 +2.91 −6.82]
State 412, Action N, Q-values: [−4.20 −3.69 −4.17 −4.48 −12.72 −12.96]
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State 413, Action N, Q-values: [−2.88 −2.52 −2.97 −3.03 −10.35 −11.77]
State 414, Action N, Q-values: [−4.27 −3.82 −4.32 −4.28 −12.14 −13.08]
State 415, Action W, Q-values: [+3.26 +3.15 +2.89 +3.41 −4.37 −2.39]
State 416, Action N, Q-values: [+8.20 +9.78 +7.96 +8.73 +2.06 +6.61]
State 417, Action N, Q-values: [+1.76 +3.13 +2.53 +1.61 −6.38 −0.44]
State 418, Action D, Q-values: [+16.88 +14.06 +15.74 +16.46 +8.15 +19.86]
State 419, Action N, Q-values: [+3.05 +4.52 +3.86 +3.36 −4.87 +0.09]
State 420, Action W, Q-values: [+3.32 +3.23 +2.92 +3.35 −4.18 −2.27]
State 421, Action N, Q-values: [−3.56 −2.89 −3.76 −3.64 −11.29 −12.15]
State 422, Action N, Q-values: [−0.44 +0.50 −0.38 −0.25 −9.13 −9.31]
State 423, Action N, Q-values: [−2.71 −2.29 −3.06 −2.83 −11.43 −11.73]
State 424, Action E, Q-values: [−4.64 −4.37 −4.37 −4.71 −13.31 −13.52]
State 425, Action W, Q-values: [+3.22 +3.11 +2.85 +3.23 −4.24 −2.42]
State 426, Action E, Q-values: [−4.61 −4.30 −4.22 −4.80 −14.22 −13.71]
State 427, Action E, Q-values: [−2.85 −2.47 −2.18 −2.61 −11.16 −12.26]
State 428, Action N, Q-values: [+0.20 +0.99 +0.07 +0.31 −8.96 −9.27]
State 429, Action N, Q-values: [−3.46 −3.03 −3.73 −3.57 −9.68 −11.79]
State 430, Action S, Q-values: [+3.26 +3.13 +2.80 +3.25 −4.19 −2.63]
State 431, Action N, Q-values: [−3.55 −2.21 −3.46 −3.38 −12.19 −11.73]
State 432, Action N, Q-values: [−3.25 −2.90 −3.17 −3.36 −10.38 −11.42]
State 433, Action E, Q-values: [−1.80 −1.59 −1.54 −1.79 −10.26 −10.39]
State 434, Action E, Q-values: [−3.60 −3.31 −3.10 −3.56 −10.07 −12.80]
State 435, Action W, Q-values: [+3.31 +3.01 +2.96 +3.37 −4.16 −2.50]
State 436, Action N, Q-values: [+4.93 +5.82 +4.34 +4.95 −3.49 −1.99]
State 437, Action N, Q-values: [+3.90 +4.25 +3.96 +4.00 −4.89 −3.54]
State 438, Action N, Q-values: [+5.52 +6.87 +4.97 +5.53 −3.12 −1.88]
State 439, Action N, Q-values: [+4.36 +5.01 +4.47 +4.45 −4.70 −2.88]
State 440, Action W, Q-values: [+3.21 +3.08 +2.87 +3.26 −4.49 −2.83]
State 441, Action N, Q-values: [−4.31 −3.67 −4.48 −4.13 −11.67 −13.41]
State 442, Action N, Q-values: [−1.12 −0.36 −1.39 −0.67 −9.40 −11.27]
State 443, Action N, Q-values: [−3.36 −2.86 −3.41 −3.42 −9.61 −12.41]
State 444, Action N, Q-values: [−3.89 −3.53 −3.77 −3.99 −11.92 −12.25]
State 445, Action W, Q-values: [+3.27 +3.12 +2.93 +3.37 −3.98 −2.50]
State 446, Action N, Q-values: [−4.14 −3.75 −3.97 −4.20 −12.62 −12.52]
State 447, Action N, Q-values: [−1.70 −1.30 −1.83 −2.07 −9.71 −10.14]
State 448, Action N, Q-values: [−1.37 −0.49 −1.12 −0.62 −9.90 −11.04]
State 449, Action N, Q-values: [−3.90 −3.66 −3.86 −3.90 −11.74 −12.90]
State 450, Action W, Q-values: [+3.30 +3.03 +2.85 +3.33 −4.34 −3.01]
State 451, Action N, Q-values: [−3.42 −3.07 −3.31 −3.17 −10.65 −12.07]
State 452, Action N, Q-values: [−2.53 −2.19 −2.55 −3.10 −10.03 −11.03]
State 453, Action N, Q-values: [−1.57 −0.48 −1.16 −1.59 −10.51 −10.23]
State 454, Action N, Q-values: [−2.79 −2.35 −2.77 −3.04 −10.69 −11.05]
State 455, Action W, Q-values: [+3.27 +3.28 +2.94 +3.45 −4.18 −2.66]
State 456, Action N, Q-values: [+5.11 +6.11 +4.91 +5.65 −3.50 −2.14]
State 457, Action N, Q-values: [+4.50 +5.45 +4.39 +4.24 −3.43 −2.18]
State 458, Action N, Q-values: [+5.04 +6.16 +4.98 +5.47 −3.62 −2.27]
State 459, Action N, Q-values: [+5.64 +6.73 +5.67 +5.22 −2.59 −0.86]
State 460, Action W, Q-values: [+3.12 +3.10 +2.87 +3.14 −4.34 −2.82]
State 461, Action N, Q-values: [−4.67 −4.29 −4.63 −4.65 −14.32 −13.95]
State 462, Action N, Q-values: [−1.90 −1.28 −1.94 −1.87 −9.41 −10.60]
State 463, Action N, Q-values: [−3.96 −3.58 −4.07 −4.07 −12.15 −12.67]
State 464, Action E, Q-values: [−3.25 −3.15 −2.97 −3.36 −11.72 −12.03]
State 465, Action W, Q-values: [+3.43 +3.37 +3.04 +3.48 −4.16 −2.35]
State 466, Action N, Q-values: [−3.42 −2.94 −3.35 −3.48 −9.93 −12.77]
State 467, Action E, Q-values: [−1.43 −0.60 −0.52 −1.44 −9.96 −10.79]
State 468, Action N, Q-values: [−1.81 −1.35 −1.97 −1.75 −9.10 −10.90]
State 469, Action N, Q-values: [−4.97 −4.38 −5.12 −5.24 −14.52 −14.93]
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State 470, Action W, Q-values: [+3.17 +2.97 +2.83 +3.19 −4.28 −2.78]
State 471, Action N, Q-values: [−4.26 −3.76 −4.28 −4.29 −13.32 −12.74]
State 472, Action P, Q-values: [+2.14 +0.46 +1.19 +1.72 +2.82 −6.17]
State 473, Action P, Q-values: [+4.06 +3.18 +2.79 +4.17 +5.87 −2.68]
State 474, Action P, Q-values: [+2.01 +0.72 +1.15 +1.79 +2.92 −6.66]
State 475, Action W, Q-values: [+2.96 +2.75 +2.54 +2.96 −4.54 −3.28]
State 476, Action N, Q-values: [+3.53 +4.63 +3.21 +3.73 −4.79 +1.65]
State 477, Action N, Q-values: [+5.70 +7.94 +7.66 +5.64 −2.25 +2.76]
State 478, Action N, Q-values: [+3.06 +4.34 +2.21 +3.46 −4.78 +0.70]
State 479, Action D, Q-values: [+16.57 +14.00 +13.92 +16.19 +8.46 +19.98]
State 480, Action W, Q-values: [+3.38 +3.21 +3.01 +3.41 −3.98 −2.65]
State 481, Action N, Q-values: [−5.37 −4.94 −5.46 −5.08 −15.69 −15.89]
State 482, Action N, Q-values: [−2.80 −2.31 −2.70 −2.43 −11.02 −11.74]
State 483, Action N, Q-values: [−4.65 −4.26 −4.63 −4.37 −13.65 −13.84]
State 484, Action N, Q-values: [−2.95 −2.20 −3.06 −3.50 −9.53 −11.32]
State 485, Action W, Q-values: [+3.14 +3.00 +2.78 +3.30 −4.37 −2.72]
State 486, Action N, Q-values: [−2.99 −2.38 −2.98 −2.99 −10.65 −11.04]
State 487, Action N, Q-values: [−0.30 +0.60 −0.06 −0.39 −10.27 −8.74]
State 488, Action N, Q-values: [−2.71 −2.18 −2.81 −2.92 −8.73 −11.20]
State 489, Action N, Q-values: [−5.40 −4.90 −5.42 −5.25 −15.85 −16.12]
State 490, Action W, Q-values: [+3.25 +2.94 +2.86 +3.26 −4.32 −2.65]
State 491, Action N, Q-values: [−4.85 −4.30 −4.80 −4.52 −13.56 −14.63]
State 492, Action W, Q-values: [+0.43 −0.11 +0.91 +1.54 −7.89 −9.86]
State 493, Action W, Q-values: [+3.92 +1.85 +3.77 +4.37 −5.95 −7.14]
State 494, Action W, Q-values: [+0.47 −0.35 +0.88 +1.62 −8.22 −9.27]
State 495, Action W, Q-values: [+3.20 +3.10 +2.82 +3.24 −4.33 −2.87]
State 496, Action N, Q-values: [+2.76 +3.34 +2.51 +3.17 −6.45 −4.86]
State 497, Action N, Q-values: [+7.78 +9.83 +8.69 +6.94 +0.83 +1.58]
State 498, Action W, Q-values: [+2.57 +2.67 +2.14 +2.77 −6.54 −5.77]
State 499, Action W, Q-values: [+14.52 +13.11 +13.96 +16.88 +5.54 +7.03]
Episode 1: Total Reward = 3
Episode 2: Total Reward = 7
Episode 3: Total Reward = 7
Episode 4: Total Reward = 6
Episode 5: Total Reward = 11
Episode 6: Total Reward = 9
Episode 7: Total Reward = 8
Episode 8: Total Reward = 10
Episode 9: Total Reward = 6
Episode 10: Total Reward = 10
Episode 11: Total Reward = 8
Episode 12: Total Reward = 5
Episode 13: Total Reward = 8
Episode 14: Total Reward = 5
Episode 15: Total Reward = 10
Episode 16: Total Reward = 11
Episode 17: Total Reward = 9
Episode 18: Total Reward = 7
Episode 19: Total Reward = 12
Episode 20: Total Reward = 7
Episode 21: Total Reward = 5
Episode 22: Total Reward = 6
Episode 23: Total Reward = 5
Episode 24: Total Reward = 13
Episode 25: Total Reward = 6
Episode 26: Total Reward = 10
Episode 27: Total Reward = 4
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Episode 28: Total Reward = 5
Episode 29: Total Reward = 6
Episode 30: Total Reward = 8
Episode 31: Total Reward = 7
Episode 32: Total Reward = 6
Episode 33: Total Reward = 9
Episode 34: Total Reward = 8
Episode 35: Total Reward = 4
Episode 36: Total Reward = 6
Episode 37: Total Reward = 8
Episode 38: Total Reward = 10
Episode 39: Total Reward = 9
Episode 40: Total Reward = 10
Episode 41: Total Reward = 5
Episode 42: Total Reward = 8
Episode 43: Total Reward = 10
Episode 44: Total Reward = 7
Episode 45: Total Reward = 8
Episode 46: Total Reward = 6
Episode 47: Total Reward = 10
Episode 48: Total Reward = 8
Episode 49: Total Reward = 11
Episode 50: Total Reward = 7
Episode 51: Total Reward = 10
Episode 52: Total Reward = 5
Episode 53: Total Reward = 9
Episode 54: Total Reward = 10
Episode 55: Total Reward = 6
Episode 56: Total Reward = 9
Episode 57: Total Reward = 5
Episode 58: Total Reward = 11
Episode 59: Total Reward = 7
Episode 60: Total Reward = 8
Episode 61: Total Reward = 4
Episode 62: Total Reward = 11
Episode 63: Total Reward = 9
Episode 64: Total Reward = 12
Episode 65: Total Reward = 9
Episode 66: Total Reward = 4
Episode 67: Total Reward = 7
Episode 68: Total Reward = 5
Episode 69: Total Reward = 9
Episode 70: Total Reward = 6
Episode 71: Total Reward = 10
Episode 72: Total Reward = 8
Episode 73: Total Reward = 4
Episode 74: Total Reward = 8
Episode 75: Total Reward = 10
Episode 76: Total Reward = 10
Episode 77: Total Reward = 3
Episode 78: Total Reward = 4
Episode 79: Total Reward = 5
Episode 80: Total Reward = 7
Episode 81: Total Reward = 6
Episode 82: Total Reward = 4
Episode 83: Total Reward = 4
Episode 84: Total Reward = 10
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Episode 85: Total Reward = 8
Episode 86: Total Reward = 6
Episode 87: Total Reward = 9
Episode 88: Total Reward = 4
Episode 89: Total Reward = 8
Episode 90: Total Reward = 8
Episode 91: Total Reward = 9
Episode 92: Total Reward = 8
Episode 93: Total Reward = 5
Episode 94: Total Reward = 6
Episode 95: Total Reward = 7
Episode 96: Total Reward = 10
Episode 97: Total Reward = 10
Episode 98: Total Reward = 10
Episode 99: Total Reward = 8
Episode 100: Total Reward = 8
Episode 101: Total Reward = 3
Episode 102: Total Reward = 5
Episode 103: Total Reward = 4
Episode 104: Total Reward = 11
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Episode 825: Total Reward = 9
```

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Episode 826: Total Reward = 10
Episode 827: Total Reward = 6
Episode 828: Total Reward = 8
Episode 829: Total Reward = 5
Episode 830: Total Reward = 11
Episode 831: Total Reward = 11
Episode 832: Total Reward = 9
Episode 833: Total Reward = 10
Episode 834: Total Reward = 14
Episode 835: Total Reward = 10
Episode 836: Total Reward = 9
Episode 837: Total Reward = 6
Episode 838: Total Reward = 11
Episode 839: Total Reward = 8
Episode 840: Total Reward = 8
Episode 841: Total Reward = 7
Episode 842: Total Reward = 9
Episode 843: Total Reward = 9
Episode 844: Total Reward = 6
Episode 845: Total Reward = 4
Episode 846: Total Reward = 5
Episode 847: Total Reward = 9
Episode 848: Total Reward = 9
Episode 849: Total Reward = 5
Episode 850: Total Reward = 7
Episode 851: Total Reward = 4
Episode 852: Total Reward = 10
Episode 853: Total Reward = 6
Episode 854: Total Reward = 8
Episode 855: Total Reward = 10
Episode 856: Total Reward = 12
Episode 857: Total Reward = 11
Episode 858: Total Reward = 8
Episode 859: Total Reward = 9
Episode 860: Total Reward = 9
Episode 861: Total Reward = 7
Episode 862: Total Reward = 6
Episode 863: Total Reward = 13
Episode 864: Total Reward = 8
Episode 865: Total Reward = 8
Episode 866: Total Reward = 8
Episode 867: Total Reward = 7
Episode 868: Total Reward = 10
Episode 869: Total Reward = 12
Episode 870: Total Reward = 8
Episode 871: Total Reward = 7
Episode 872: Total Reward = 8
Episode 873: Total Reward = 7
Episode 874: Total Reward = 10
Episode 875: Total Reward = 12
Episode 876: Total Reward = 6
Episode 877: Total Reward = 11
Episode 878: Total Reward = 5
Episode 879: Total Reward = 10
Episode 880: Total Reward = 10
Episode 881: Total Reward = 5
Episode 882: Total Reward = 7
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Episode 883: Total Reward = 5
Episode 884: Total Reward = 12
Episode 885: Total Reward = 8
Episode 886: Total Reward = 8
Episode 887: Total Reward = 6
Episode 888: Total Reward = 8
Episode 889: Total Reward = 10
Episode 890: Total Reward = 8
Episode 891: Total Reward = 9
Episode 892: Total Reward = 5
Episode 893: Total Reward = 7
Episode 894: Total Reward = 4
Episode 895: Total Reward = 9
Episode 896: Total Reward = 10
Episode 897: Total Reward = 8
Episode 898: Total Reward = 9
Episode 899: Total Reward = 4
Episode 900: Total Reward = 6
Episode 901: Total Reward = 4
Episode 902: Total Reward = 11
Episode 903: Total Reward = 4
Episode 904: Total Reward = 7
Episode 905: Total Reward = 6
Episode 906: Total Reward = 7
Episode 907: Total Reward = 8
Episode 908: Total Reward = 11
Episode 909: Total Reward = 10
Episode 910: Total Reward = 10
Episode 911: Total Reward = 4
Episode 912: Total Reward = 11
Episode 913: Total Reward = 7
Episode 914: Total Reward = 4
Episode 915: Total Reward = 6
Episode 916: Total Reward = 7
Episode 917: Total Reward = 12
Episode 918: Total Reward = 8
Episode 919: Total Reward = 8
Episode 920: Total Reward = 6
Episode 921: Total Reward = 5
Episode 922: Total Reward = 5
Episode 923: Total Reward = 7
Episode 924: Total Reward = 4
Episode 925: Total Reward = 8
Episode 926: Total Reward = 11
Episode 927: Total Reward = 8
Episode 928: Total Reward = 7
Episode 929: Total Reward = 5
Episode 930: Total Reward = 8
Episode 931: Total Reward = 10
Episode 932: Total Reward = 10
Episode 933: Total Reward = 10
Episode 934: Total Reward = 5
Episode 935: Total Reward = 8
Episode 936: Total Reward = 4
Episode 937: Total Reward = 4
Episode 938: Total Reward = 8
Episode 939: Total Reward = 5
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Episode 940: Total Reward = 7
Episode 941: Total Reward = 6
Episode 942: Total Reward = 8
Episode 943: Total Reward = 13
Episode 944: Total Reward = 12
Episode 945: Total Reward = 11
Episode 946: Total Reward = 7
Episode 947: Total Reward = 4
Episode 948: Total Reward = 5
Episode 949: Total Reward = 10
Episode 950: Total Reward = 8
Episode 951: Total Reward = 6
Episode 952: Total Reward = 6
Episode 953: Total Reward = 7
Episode 954: Total Reward = 6
Episode 955: Total Reward = 6
Episode 956: Total Reward = 11
Episode 957: Total Reward = 9
Episode 958: Total Reward = 4
Episode 959: Total Reward = 6
Episode 960: Total Reward = 6
Episode 961: Total Reward = 8
Episode 962: Total Reward = 8
Episode 963: Total Reward = 10
Episode 964: Total Reward = 6
Episode 965: Total Reward = 7
Episode 966: Total Reward = 6
Episode 967: Total Reward = 8
Episode 968: Total Reward = 9
Episode 969: Total Reward = 3
Episode 970: Total Reward = 9
Episode 971: Total Reward = 8
Episode 972: Total Reward = 8
Episode 973: Total Reward = 12
Episode 974: Total Reward = 8
Episode 975: Total Reward = 6
Episode 976: Total Reward = 6
Episode 977: Total Reward = 7
Episode 978: Total Reward = 7
Episode 979: Total Reward = 4
Episode 980: Total Reward = 12
Episode 981: Total Reward = 6
Episode 982: Total Reward = 5
Episode 983: Total Reward = 14
Episode 984: Total Reward = 5
Episode 985: Total Reward = 11
Episode 986: Total Reward = 4
Episode 987: Total Reward = 8
Episode 988: Total Reward = 5
Episode 989: Total Reward = 5
Episode 990: Total Reward = 5
Episode 991: Total Reward = 10
Episode 992: Total Reward = 6
Episode 993: Total Reward = 9
Episode 994: Total Reward = 3
Episode 995: Total Reward = 10
Episode 996: Total Reward = 6
```

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Episode 997: Total Reward = 7
Episode 998: Total Reward = 5
Episode 999: Total Reward = 7
Episode 1000: Total Reward = 12
Average Reward across all Episodes: = 7.942
CPU times: user 1.07 s, sys: 76.4 ms, total: 1.15 s
Wall time: 572 ms
```

In [140…
```python
# # only to have a look of the test play result
my_dqn_agent_fine_tuned.test(test_episodes=5, display=True)
```


Taxi-v3 | Episode: 4 | Step: 13
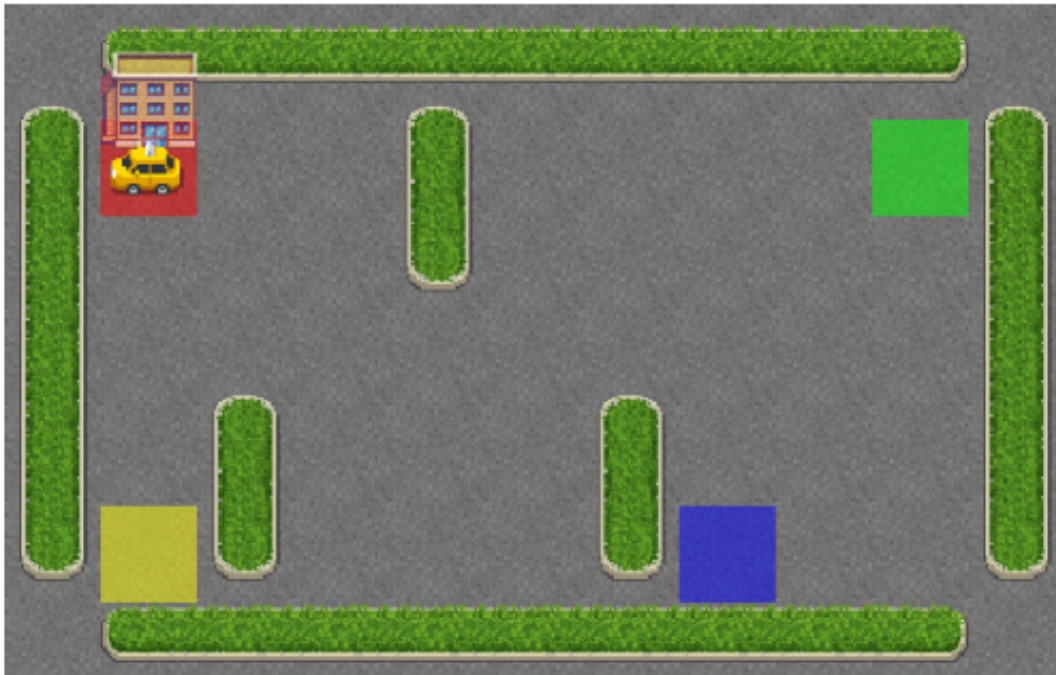
```
Episode 5: Total Reward = 8
Average Reward across all Episodes: = 9.6
```

Out[140… [7, 12, 11, 10, 8]

Taxi-v3 | Episode: 4 | Step: 13
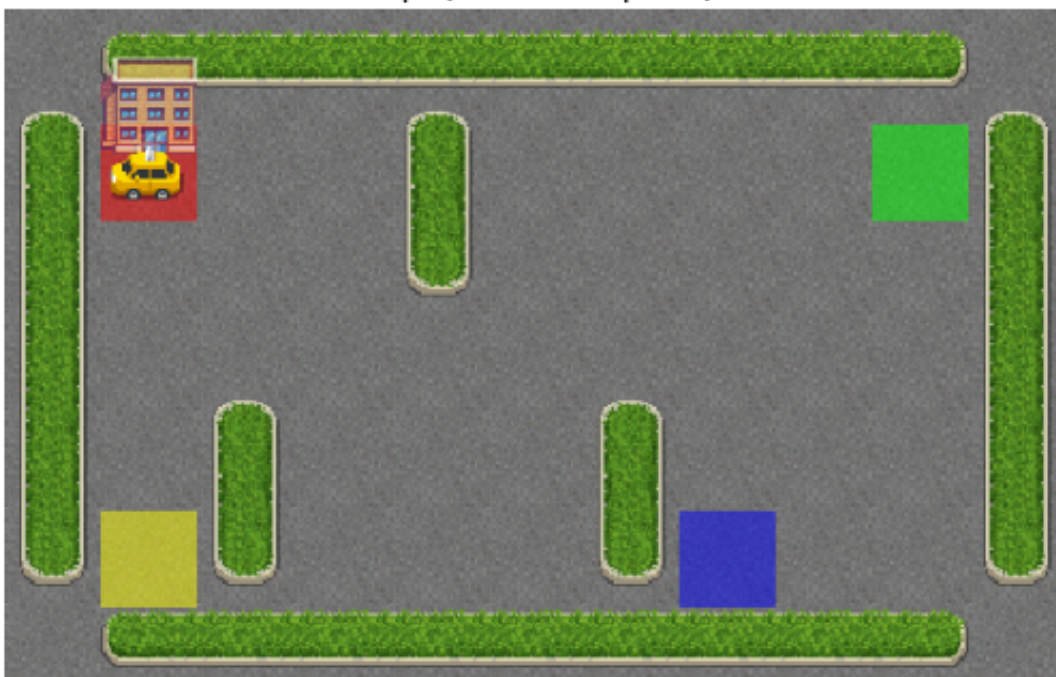
```
my_dqn_agent_fine_tuned.test_to_gif(filename="taxi_dqn_fine_tuned",episod
```

Policy (trained):
State 000, Action S, Q-values: [+3.28 +3.01 +2.85 +3.27 −4.17 −2.62]
State 001, Action P, Q-values: [+0.17 +0.51 +0.57 +0.64 +1.72 −6.86]
State 002, Action P, Q-values: [+5.46 +5.76 +4.29 +6.53 +7.65 −2.60]
State 003, Action P, Q-values: [+1.27 +1.33 +1.11 +1.69 +3.00 −7.17]
State 004, Action S, Q-values: [−4.84 −5.12 −5.00 −5.37 −14.29 −14.66]
State 005, Action W, Q-values: [+3.10 +3.06 +2.64 +3.19 −4.00 −2.64]
State 006, Action S, Q-values: [−4.83 −5.08 −4.89 −5.14 −14.37 −14.43]
State 007, Action E, Q-values: [−3.05 −3.31 −2.98 −3.39 −9.20 −11.68]
State 008, Action S, Q-values: [+1.77 +0.60 +0.63 +1.38 −8.76 −8.22]
State 009, Action S, Q-values: [−2.45 −2.82 −2.88 −2.80 −10.67 −11.53]
State 010, Action W, Q-values: [+3.19 +3.11 +2.82 +3.23 −4.32 −2.96]
State 011, Action S, Q-values: [−1.67 −1.81 −2.20 −2.27 −10.43 −11.18]
State 012, Action S, Q-values: [−3.88 −4.30 −3.91 −4.65 −11.24 −13.40]
State 013, Action S, Q-values: [−2.29 −2.68 −2.33 −2.46 −10.81 −11.76]
State 014, Action E, Q-values: [−4.04 −4.19 −3.84 −4.35 −12.32 −13.25]
State 015, Action W, Q-values: [+3.16 +3.09 +2.76 +3.16 −4.39 −2.88]
State 016, Action D, Q-values: [+14.90 +15.38 +13.90 +16.09 +8.30 +20.03]
State 017, Action E, Q-values: [+2.87 +1.35 +2.92 +2.44 −6.18 −0.67]
State 018, Action S, Q-values: [+9.49 +7.12 +5.77 +7.40 −1.43 +4.66]
State 019, Action S, Q-values: [+4.39 +3.10 +4.37 +3.53 −5.63 +0.87]
State 020, Action W, Q-values: [+3.20 +3.10 +2.78 +3.24 −4.06 −2.63]
State 021, Action W, Q-values: [−0.05 −0.26 +0.12 +0.58 −7.31 −7.82]
State 022, Action W, Q-values: [+3.31 +4.42 +3.77 +5.83 −3.53 −4.08]
State 023, Action W, Q-values: [+0.73 +0.77 +1.18 +1.64 −6.70 −7.48]
State 024, Action S, Q-values: [−4.37 −4.66 −4.64 −4.71 −14.45 −14.34]
State 025, Action S, Q-values: [+3.14 +2.87 +2.68 +3.12 −4.41 −2.93]
State 026, Action S, Q-values: [−4.53 −4.81 −5.03 −5.24 −12.72 −13.94]
State 027, Action S, Q-values: [−2.32 −2.90 −2.84 −2.96 −10.37 −11.39]
State 028, Action W, Q-values: [+0.42 −0.34 +0.11 +0.53 −9.63 −10.35]
State 029, Action W, Q-values: [−3.31 −3.59 −3.53 −3.07 −11.48 −13.07]
State 030, Action W, Q-values: [+3.28 +2.94 +2.88 +3.34 −4.26 −2.93]
State 031, Action S, Q-values: [−2.35 −2.46 −3.07 −2.51 −10.72 −11.65]
State 032, Action S, Q-values: [−3.14 −3.29 −3.48 −4.02 −10.94 −12.30]
State 033, Action S, Q-values: [−1.41 −1.79 −1.82 −2.12 −10.04 −10.35]
State 034, Action S, Q-values: [−3.23 −3.47 −3.71 −3.91 −10.62 −12.90]
State 035, Action W, Q-values: [+3.19 +3.05 +2.85 +3.25 −4.48 −2.68]
State 036, Action W, Q-values: [+12.91 +13.86 +13.56 +16.76 +5.14 +6.30]
State 037, Action S, Q-values: [+4.30 +2.61 +3.24 +2.49 −5.90 −5.91]
State 038, Action W, Q-values: [+7.10 +6.05 +5.87 +7.36 −2.65 −1.84]
State 039, Action S, Q-values: [+5.98 +4.72 +4.48 +4.06 −3.63 −3.60]
State 040, Action W, Q-values: [+3.14 +2.86 +2.74 +3.17 −4.34 −2.60]
State 041, Action S, Q-values: [−3.89 −4.33 −4.29 −4.09 −11.28 −13.41]
State 042, Action S, Q-values: [−0.66 −1.75 −2.03 −1.65 −10.78 −10.93]
State 043, Action S, Q-values: [−3.22 −3.46 −3.70 −3.51 −11.22 −12.15]
State 044, Action E, Q-values: [−1.65 −0.89 −0.35 −1.40 −9.95 −10.54]
State 045, Action W, Q-values: [+3.26 +3.09 +2.81 +3.33 −4.21 −2.91]
State 046, Action E, Q-values: [−1.33 −1.10 −0.54 −1.04 −9.22 −10.28]
State 047, Action E, Q-values: [+0.97 +1.60 +3.02 +1.19 −5.03 −7.55]
State 048, Action S, Q-values: [−0.60 −1.20 −1.30 −1.08 −10.14 −10.35]
State 049, Action S, Q-values: [−3.80 −4.12 −4.14 −4.33 −11.31 −12.97]
State 050, Action W, Q-values: [+3.33 +3.26 +2.95 +3.35 −4.49 −2.74]
State 051, Action S, Q-values: [−3.10 −3.82 −3.32 −3.52 −11.87 −12.58]
State 052, Action E, Q-values: [−2.64 −2.82 −2.59 −3.25 −11.71 −11.66]
State 053, Action E, Q-values: [−0.83 −1.28 −0.42 −0.91 −10.03 −10.42]

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State 054, Action E, Q-values: [-2.38 -2.70 -2.36 -2.70 -11.20 -11.19]
State 055, Action S, Q-values: [+3.40 +3.18 +2.93 +3.34 -4.27 -2.64]
State 056, Action S, Q-values: [+5.92 +5.03 +4.02 +5.09 -3.35 -3.30]
State 057, Action E, Q-values: [+10.33 +11.85 +14.26 +10.91 +4.55 +4.71]
State 058, Action S, Q-values: [+5.83 +4.86 +3.71 +5.06 -4.08 -3.19]
State 059, Action E, Q-values: [+6.78 +5.84 +7.26 +6.58 -2.72 -1.36]
State 060, Action W, Q-values: [+2.84 +2.71 +2.47 +2.92 -4.69 -3.12]
State 061, Action S, Q-values: [-4.57 -4.79 -4.89 -4.58 -14.14 -14.15]
State 062, Action S, Q-values: [-1.49 -1.97 -2.02 -1.54 -10.21 -11.28]
State 063, Action S, Q-values: [-3.84 -4.22 -4.28 -4.17 -11.58 -13.02]
State 064, Action E, Q-values: [-1.36 -0.23 +0.74 -1.19 -6.77 -8.24]
State 065, Action W, Q-values: [+3.18 +3.10 +2.82 +3.24 -4.27 -2.95]
State 066, Action E, Q-values: [-1.12 +0.13 +0.52 -0.58 -7.91 -6.43]
State 067, Action E, Q-values: [+1.78 +3.11 +4.45 +1.98 -3.57 -4.49]
State 068, Action W, Q-values: [-1.72 -2.07 -2.25 -1.68 -9.42 -10.81]
State 069, Action S, Q-values: [-4.48 -4.74 -5.06 -4.85 -13.59 -14.07]
State 070, Action W, Q-values: [+3.07 +2.92 +2.73 +3.22 -4.11 -2.86]
State 071, Action S, Q-values: [-3.67 -3.93 -3.75 -3.69 -11.93 -12.63]
State 072, Action S, Q-values: [-1.41 -1.68 -2.02 -2.06 -10.52 -10.72]
State 073, Action S, Q-values: [+0.43 -0.60 -0.65 -0.43 -9.72 -9.27]
State 074, Action S, Q-values: [-1.50 -2.10 -2.25 -2.21 -10.16 -10.79]
State 075, Action W, Q-values: [+3.15 +3.05 +2.78 +3.21 -4.57 -2.87]
State 076, Action S, Q-values: [+4.43 +3.37 +2.63 +4.29 -4.72 -5.19]
State 077, Action E, Q-values: [+11.82 +13.76 +16.95 +11.84 +4.25 +4.90]
State 078, Action S, Q-values: [+4.27 +3.38 +2.18 +4.22 -5.85 -5.90]
State 079, Action S, Q-values: [+9.63 +7.63 +6.29 +6.77 -1.32 -0.44]
State 080, Action S, Q-values: [+3.16 +2.92 +2.75 +3.14 -4.34 -3.00]
State 081, Action W, Q-values: [-5.13 -5.23 -5.37 -5.11 -14.98 -15.32]
State 082, Action S, Q-values: [-2.40 -2.88 -2.89 -2.63 -10.32 -11.89]
State 083, Action S, Q-values: [-4.39 -4.66 -4.47 -4.42 -13.80 -13.51]
State 084, Action P, Q-values: [+0.46 +0.26 +0.79 +0.66 +1.84 -5.96]
State 085, Action W, Q-values: [+3.13 +2.96 +2.82 +3.21 -4.19 -2.78]
State 086, Action P, Q-values: [+0.66 +0.59 +1.13 +0.86 +1.69 -6.19]
State 087, Action P, Q-values: [+3.58 +4.38 +3.99 +3.97 +6.05 -3.02]
State 088, Action W, Q-values: [-2.90 -3.20 -3.22 -2.73 -11.05 -12.46]
State 089, Action W, Q-values: [-5.11 -5.16 -5.07 -5.05 -14.55 -15.10]
State 090, Action W, Q-values: [+3.17 +3.17 +2.90 +3.25 -4.33 -3.04]
State 091, Action W, Q-values: [-4.42 -4.64 -4.59 -4.31 -12.12 -13.83]
State 092, Action W, Q-values: [-2.46 -2.55 -2.66 -2.41 -10.66 -11.40]
State 093, Action W, Q-values: [-0.70 -1.11 -0.79 -0.48 -10.35 -10.19]
State 094, Action S, Q-values: [-2.07 -2.64 -2.50 -2.25 -11.00 -11.23]
State 095, Action W, Q-values: [+3.12 +3.07 +2.80 +3.18 -4.11 -2.87]
State 096, Action S, Q-values: [+2.94 +1.92 +2.00 +2.94 -6.36 -0.98]
State 097, Action D, Q-values: [+14.81 +14.99 +15.37 +14.58 +7.62 +19.94]
State 098, Action S, Q-values: [+2.91 +1.86 +1.81 +2.86 -6.68 -1.94]
State 099, Action S, Q-values: [+7.60 +6.04 +6.10 +7.52 -2.24 +3.22]
State 100, Action W, Q-values: [+3.16 +3.09 +2.81 +3.20 -4.61 -3.08]
State 101, Action N, Q-values: [-0.35 +0.68 -0.98 -0.09 -6.98 -6.63]
State 102, Action N, Q-values: [+3.48 +6.11 +4.04 +5.07 -3.65 -2.88]
State 103, Action N, Q-values: [+0.68 +1.86 +0.11 +0.96 -7.56 -6.81]
State 104, Action E, Q-values: [-4.46 -5.15 -4.35 -4.66 -13.36 -13.92]
State 105, Action W, Q-values: [+3.37 +3.28 +3.05 +3.39 -4.28 -2.51]
State 106, Action E, Q-values: [-4.41 -4.99 -4.38 -4.81 -13.70 -13.85]
State 107, Action E, Q-values: [-2.42 -2.54 -2.42 -2.67 -10.41 -11.12]
State 108, Action S, Q-values: [+2.79 +1.10 +0.98 +1.75 -7.07 -6.63]
State 109, Action S, Q-values: [-1.58 -2.81 -2.49 -2.20 -9.97 -11.05]
State 110, Action W, Q-values: [+3.20 +2.96 +2.81 +3.24 -4.03 -2.58]
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State 111, Action S, Q-values: [−0.68 −1.40 −1.44 −1.23 −10.04 −10.03]
State 112, Action S, Q-values: [−3.11 −3.26 −3.16 −3.40 −10.95 −11.66]
State 113, Action E, Q-values: [−1.65 −2.37 −1.46 −1.88 −10.56 −10.13]
State 114, Action S, Q-values: [−3.25 −3.85 −3.32 −3.76 −11.02 −12.18]
State 115, Action W, Q-values: [+3.34 +3.16 +3.01 +3.37 −3.98 −2.69]
State 116, Action N, Q-values: [+11.94 +17.15 +13.50 +14.09 +5.26 +5.05]
State 117, Action E, Q-values: [+4.24 +2.00 +4.34 +3.05 −6.06 −5.24]
State 118, Action S, Q-values: [+11.80 +8.91 +8.18 +9.64 +0.33 +0.26]
State 119, Action E, Q-values: [+6.00 +3.31 +6.01 +4.91 −4.32 −4.09]
State 120, Action W, Q-values: [+3.14 +3.05 +2.71 +3.26 −4.17 −3.06]
State 121, Action N, Q-values: [−1.19 −0.23 −0.92 −0.36 −8.20 −8.23]
State 122, Action N, Q-values: [+3.02 +4.35 +3.04 +3.58 −5.15 −2.96]
State 123, Action N, Q-values: [−0.14 +0.64 +0.09 +0.51 −8.88 −7.49]
State 124, Action S, Q-values: [−3.90 −4.48 −4.24 −4.77 −12.89 −12.73]
State 125, Action W, Q-values: [+3.27 +3.06 +2.80 +3.32 −3.85 −2.49]
State 126, Action S, Q-values: [−3.77 −4.15 −4.16 −4.24 −11.90 −12.97]
State 127, Action S, Q-values: [−1.29 −2.26 −1.73 −1.66 −10.30 −10.26]
State 128, Action W, Q-values: [+1.64 +0.46 +0.94 +1.73 −8.72 −9.16]
State 129, Action S, Q-values: [−2.36 −2.87 −2.82 −2.62 −10.24 −10.90]
State 130, Action W, Q-values: [+3.18 +2.99 +2.75 +3.22 −4.06 −2.87]
State 131, Action S, Q-values: [−1.44 −1.98 −1.68 −1.48 −9.91 −10.28]
State 132, Action S, Q-values: [−2.38 −2.91 −2.92 −2.92 −9.59 −10.94]
State 133, Action S, Q-values: [−0.41 −1.00 −0.90 −0.88 −9.55 −9.47]
State 134, Action S, Q-values: [−2.45 −3.03 −2.80 −3.10 −10.73 −11.29]
State 135, Action S, Q-values: [+3.21 +3.00 +2.83 +3.16 −4.12 −2.96]
State 136, Action N, Q-values: [+10.34 +14.31 +12.27 +12.50 +4.29 +3.85]
State 137, Action S, Q-values: [+5.96 +3.33 +4.49 +3.93 −3.71 −4.33]
State 138, Action S, Q-values: [+9.60 +6.93 +7.41 +8.54 −1.40 −2.57]
State 139, Action S, Q-values: [+7.70 +4.96 +5.69 +5.29 −2.22 −2.54]
State 140, Action W, Q-values: [+3.25 +3.07 +2.82 +3.27 −4.41 −3.12]
State 141, Action S, Q-values: [−3.06 −3.72 −3.60 −3.60 −9.83 −11.03]
State 142, Action S, Q-values: [+0.29 −0.68 −1.04 −0.21 −8.25 −9.18]
State 143, Action S, Q-values: [−2.38 −3.54 −3.36 −3.09 −9.96 −11.28]
State 144, Action N, Q-values: [−2.62 −1.22 −1.42 −2.26 −10.21 −9.89]
State 145, Action W, Q-values: [+3.32 +3.23 +2.97 +3.34 −4.26 −3.01]
State 146, Action N, Q-values: [−2.99 −1.42 −1.75 −2.74 −10.20 −10.59]
State 147, Action N, Q-values: [−0.12 +1.82 +1.72 +0.03 −7.96 −7.50]
State 148, Action S, Q-values: [+0.40 −0.71 −0.94 −0.36 −8.44 −8.67]
State 149, Action S, Q-values: [−2.95 −3.90 −3.57 −3.31 −9.06 −10.67]
State 150, Action W, Q-values: [+3.31 +3.12 +2.91 +3.33 −4.42 −2.96]
State 151, Action S, Q-values: [−2.43 −3.10 −2.99 −2.93 −11.06 −11.68]
State 152, Action E, Q-values: [−1.86 −2.28 −1.55 −1.93 −10.25 −10.98]
State 153, Action S, Q-values: [+0.32 −0.69 +0.07 +0.12 −9.30 −9.10]
State 154, Action S, Q-values: [−1.54 −2.03 −1.64 −1.82 −10.24 −10.44]
State 155, Action W, Q-values: [+3.34 +3.19 +2.84 +3.36 −4.26 −2.60]
State 156, Action S, Q-values: [+7.90 +5.48 +4.84 +6.53 −2.02 −1.98]
State 157, Action N, Q-values: [+8.39 +12.10 +11.91 +9.10 +1.88 +1.43]
State 158, Action S, Q-values: [+7.60 +4.78 +4.45 +6.08 −3.07 −2.78]
State 159, Action E, Q-values: [+8.74 +6.61 +9.51 +8.21 −0.60 +1.70]
State 160, Action W, Q-values: [+3.26 +3.15 +2.90 +3.32 −4.12 −2.64]
State 161, Action S, Q-values: [−3.79 −4.77 −4.26 −3.81 −11.65 −13.47]
State 162, Action S, Q-values: [−0.74 −1.64 −1.62 −0.83 −8.87 −10.44]
State 163, Action S, Q-values: [−3.16 −3.64 −3.86 −3.27 −11.22 −12.34]
State 164, Action N, Q-values: [−1.91 −0.31 −0.36 −1.75 −8.93 −8.36]
State 165, Action W, Q-values: [+3.21 +3.01 +2.84 +3.27 −4.12 −2.56]
State 166, Action N, Q-values: [−2.14 −0.38 −0.75 −2.09 −9.99 −10.44]
State 167, Action N, Q-values: [+1.15 +3.16 +2.78 +1.11 −5.76 −3.74]
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State 168, Action S, Q-values: [−0.59 −1.49 −1.31 −0.71 −9.30 −9.99]
State 169, Action S, Q-values: [−3.83 −4.19 −4.04 −3.84 −12.08 −12.26]
State 170, Action S, Q-values: [+3.15 +2.88 +2.60 +3.11 −4.43 −3.03]
State 171, Action S, Q-values: [−3.14 −3.52 −3.71 −3.14 −10.46 −11.74]
State 172, Action S, Q-values: [−0.45 −1.28 −1.69 −1.48 −9.51 −9.64]
State 173, Action S, Q-values: [+1.67 +0.38 +0.10 +0.32 −7.95 −7.46]
State 174, Action S, Q-values: [−0.65 −1.87 −1.73 −1.62 −9.91 −10.06]
State 175, Action W, Q-values: [+3.05 +3.03 +2.78 +3.13 −4.31 −3.10]
State 176, Action S, Q-values: [+5.94 +3.87 +4.28 +5.84 −4.16 −3.92]
State 177, Action N, Q-values: [+10.55 +14.43 +14.15 +10.54 +4.42 +4.91]
State 178, Action S, Q-values: [+5.83 +3.89 +3.71 +5.80 −3.92 −4.26]
State 179, Action S, Q-values: [+11.71 +8.43 +7.63 +8.65 +0.12 +1.38]
State 180, Action W, Q-values: [+3.08 +3.11 +2.71 +3.28 −4.28 −2.98]
State 181, Action S, Q-values: [−4.30 −4.37 −4.43 −4.42 −13.65 −13.64]
State 182, Action W, Q-values: [−1.52 −1.91 −1.80 −1.51 −10.74 −10.98]
State 183, Action S, Q-values: [−3.73 −4.45 −4.28 −4.03 −11.91 −12.87]
State 184, Action N, Q-values: [−0.98 +0.82 −0.56 −0.18 −8.68 −8.32]
State 185, Action W, Q-values: [+3.20 +3.09 +2.81 +3.22 −4.31 −2.91]
State 186, Action N, Q-values: [−0.64 +0.60 −0.24 −1.08 −7.38 −6.54]
State 187, Action N, Q-values: [+2.03 +4.68 +3.67 +2.03 −3.93 −4.20]
State 188, Action S, Q-values: [−1.42 −2.14 −1.72 −1.61 −10.27 −11.23]
State 189, Action S, Q-values: [−4.33 −4.65 −4.52 −4.36 −12.80 −13.53]
State 190, Action W, Q-values: [+3.35 +3.27 +2.94 +3.40 −3.98 −2.32]
State 191, Action S, Q-values: [−3.76 −4.11 −3.97 −3.82 −11.74 −12.76]
State 192, Action S, Q-values: [−1.43 −2.00 −1.74 −1.52 −10.36 −10.93]
State 193, Action W, Q-values: [+0.48 −0.61 −0.14 +0.52 −9.45 −9.79]
State 194, Action S, Q-values: [−1.62 −2.04 −1.91 −1.65 −9.93 −10.49]
State 195, Action W, Q-values: [+2.99 +2.74 +2.58 +3.02 −4.63 −3.13]
State 196, Action W, Q-values: [+4.36 +2.56 +3.34 +4.42 −5.82 −5.63]
State 197, Action N, Q-values: [+12.06 +17.16 +14.74 +13.00 +5.49 +6.10]
State 198, Action S, Q-values: [+4.43 +2.16 +3.31 +4.30 −5.23 −6.26]
State 199, Action W, Q-values: [+9.46 +6.83 +7.55 +9.51 −1.04 −1.12]
State 200, Action W, Q-values: [+3.15 +3.12 +2.84 +3.26 −4.25 −2.97]
State 201, Action N, Q-values: [−1.27 −0.33 −1.30 −1.11 −8.92 −8.61]
State 202, Action N, Q-values: [+2.30 +4.62 +1.77 +3.60 −4.28 −4.93]
State 203, Action N, Q-values: [−0.69 +0.71 −1.31 −0.16 −8.33 −7.93]
State 204, Action E, Q-values: [−4.10 −3.91 −3.70 −4.14 −10.32 −12.18]
State 205, Action S, Q-values: [+3.09 +2.90 +2.66 +3.07 −4.41 −2.83]
State 206, Action E, Q-values: [−4.53 −4.84 −3.74 −4.29 −12.88 −13.39]
State 207, Action E, Q-values: [−2.19 −2.30 −1.19 −1.84 −10.30 −10.77]
State 208, Action S, Q-values: [+4.07 +1.73 +1.85 +2.85 −6.04 −6.07]
State 209, Action S, Q-values: [−0.49 −2.02 −1.67 −1.14 −8.94 −9.70]
State 210, Action W, Q-values: [+3.46 +3.33 +3.09 +3.53 −3.90 −2.57]
State 211, Action S, Q-values: [+0.49 −0.85 −0.74 −0.31 −8.28 −8.07]
State 212, Action E, Q-values: [−2.85 −3.15 −2.32 −2.52 −10.65 −11.63]
State 213, Action E, Q-values: [−1.87 −1.39 −0.53 −1.67 −10.68 −11.05]
State 214, Action E, Q-values: [−3.18 −3.07 −2.37 −3.08 −11.11 −11.68]
State 215, Action W, Q-values: [+3.07 +2.93 +2.64 +3.08 −4.40 −3.29]
State 216, Action N, Q-values: [+9.53 +14.32 +10.48 +11.42 +3.87 +3.33]
State 217, Action E, Q-values: [+3.58 +4.17 +6.11 +4.37 −3.82 −3.48]
State 218, Action S, Q-values: [+14.35 +9.56 +9.38 +11.70 +2.37 +3.99]
State 219, Action E, Q-values: [+4.85 +4.55 +7.74 +5.56 −1.59 −3.12]
State 220, Action W, Q-values: [+3.33 +3.22 +3.01 +3.42 −4.16 −2.43]
State 221, Action N, Q-values: [−2.68 −1.29 −2.53 −1.41 −8.71 −9.88]
State 222, Action N, Q-values: [+1.08 +3.04 +1.03 +2.90 −7.24 −6.37]
State 223, Action N, Q-values: [−1.89 −0.35 −1.79 −0.48 −9.38 −8.94]
State 224, Action E, Q-values: [−3.75 −3.64 −3.01 −3.63 −9.71 −11.80]
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State 225, Action W, Q-values: [+2.88 +2.86 +2.66 +3.02 -4.29 -3.01]
State 226, Action E, Q-values: [-3.69 -3.43 -3.06 -3.53 -10.72 -11.67]
State 227, Action E, Q-values: [-1.85 -1.37 -0.44 -1.67 -8.68 -9.06]
State 228, Action W, Q-values: [+0.99 +0.92 +0.39 +2.84 -6.80 -8.08]
State 229, Action W, Q-values: [-2.01 -2.52 -2.03 -1.51 -8.62 -9.72]
State 230, Action W, Q-values: [+3.32 +3.19 +2.95 +3.35 -4.16 -2.39]
State 231, Action W, Q-values: [-1.62 -1.59 -1.57 -0.54 -8.28 -9.68]
State 232, Action E, Q-values: [-2.83 -2.78 -1.50 -2.72 -10.06 -11.05]
State 233, Action E, Q-values: [-1.21 -0.94 +0.64 -1.37 -9.58 -10.12]
State 234, Action E, Q-values: [-2.77 -2.26 -1.53 -2.69 -10.12 -10.39]
State 235, Action W, Q-values: [+3.26 +3.17 +2.80 +3.30 -4.48 -2.82]
State 236, Action N, Q-values: [+8.09 +11.76 +8.04 +11.58 +1.13 +1.01]
State 237, Action E, Q-values: [+4.80 +4.98 +7.88 +4.73 -0.96 -1.25]
State 238, Action W, Q-values: [+8.96 +8.65 +8.51 +11.82 +0.95 -0.90]
State 239, Action E, Q-values: [+5.64 +6.64 +9.61 +5.68 -1.19 -1.24]
State 240, Action S, Q-values: [+3.41 +3.15 +2.95 +3.40 -4.06 -2.64]
State 241, Action W, Q-values: [-2.85 -2.80 -3.08 -2.34 -9.68 -10.59]
State 242, Action W, Q-values: [-0.03 -0.20 -0.12 +1.48 -7.43 -9.57]
State 243, Action W, Q-values: [-2.02 -1.98 -1.97 -1.39 -9.09 -9.37]
State 244, Action N, Q-values: [-3.48 -2.18 -2.20 -3.19 -9.93 -9.88]
State 245, Action W, Q-values: [+3.18 +2.92 +2.80 +3.26 -4.06 -2.67]
State 246, Action N, Q-values: [-3.62 -2.24 -2.28 -3.31 -10.04 -10.23]
State 247, Action N, Q-values: [-1.41 +0.56 +0.55 -1.34 -8.36 -7.99]
State 248, Action W, Q-values: [+0.91 -0.22 +0.37 +1.62 -7.96 -8.75]
State 249, Action W, Q-values: [-3.07 -3.26 -2.90 -2.30 -10.94 -11.90]
State 250, Action W, Q-values: [+3.40 +3.31 +3.04 +3.50 -4.01 -2.45]
State 251, Action W, Q-values: [-2.26 -2.54 -2.23 -1.50 -10.50 -10.88]
State 252, Action E, Q-values: [-1.98 -1.56 -0.52 -1.86 -8.87 -9.71]
State 253, Action E, Q-values: [+0.23 +0.19 +1.76 +0.51 -7.58 -6.61]
State 254, Action E, Q-values: [-1.91 -1.62 -0.52 -1.61 -8.40 -9.57]
State 255, Action W, Q-values: [+2.99 +2.95 +2.64 +3.06 -4.71 -3.08]
State 256, Action W, Q-values: [+6.35 +6.77 +6.42 +9.72 +0.34 -1.21]
State 257, Action N, Q-values: [+6.46 +9.96 +9.76 +6.33 +0.74 +0.60]
State 258, Action W, Q-values: [+6.31 +6.24 +6.03 +9.50 -0.80 -0.95]
State 259, Action E, Q-values: [+7.87 +8.42 +11.80 +7.80 +1.56 +1.81]
State 260, Action W, Q-values: [+3.32 +3.11 +2.92 +3.42 -4.27 -2.65]
State 261, Action W, Q-values: [-3.96 -4.04 -3.73 -3.11 -11.80 -12.12]
State 262, Action W, Q-values: [-1.22 -0.77 -1.18 +0.25 -9.08 -10.25]
State 263, Action W, Q-values: [-2.88 -2.70 -2.80 -2.33 -10.17 -11.51]
State 264, Action N, Q-values: [-2.94 -1.28 -1.36 -2.79 -9.75 -9.69]
State 265, Action S, Q-values: [+3.42 +3.03 +2.93 +3.38 -4.24 -2.66]
State 266, Action N, Q-values: [-2.94 -1.41 -1.45 -2.55 -9.17 -9.72]
State 267, Action N, Q-values: [-0.59 +1.83 +1.69 -0.34 -8.07 -6.99]
State 268, Action W, Q-values: [-1.05 -1.32 -1.20 +0.37 -9.26 -10.28]
State 269, Action W, Q-values: [-3.88 -3.98 -3.96 -3.03 -12.39 -13.17]
State 270, Action S, Q-values: [+3.24 +3.02 +2.88 +3.23 -4.43 -2.77]
State 271, Action W, Q-values: [-2.99 -2.88 -2.92 -2.41 -11.03 -11.50]
State 272, Action S, Q-values: [+0.49 -1.02 -1.00 -0.38 -9.28 -9.43]
State 273, Action S, Q-values: [+2.85 +0.39 +0.63 +0.72 -6.89 -6.66]
State 274, Action S, Q-values: [+0.53 -0.83 -1.26 -1.12 -9.03 -7.48]
State 275, Action W, Q-values: [+3.41 +3.21 +2.96 +3.44 -4.29 -2.66]
State 276, Action W, Q-values: [+4.25 +6.04 +4.08 +7.77 -1.93 -3.19]
State 277, Action N, Q-values: [+8.16 +12.03 +11.74 +8.38 +2.04 +1.31]
State 278, Action W, Q-values: [+4.80 +4.60 +4.47 +7.63 -1.51 -2.37]
State 279, Action S, Q-values: [+14.23 +9.41 +9.49 +10.75 +2.31 +4.74]
State 280, Action W, Q-values: [+3.24 +3.04 +2.87 +3.29 -4.27 -2.60]
State 281, Action W, Q-values: [-4.23 -4.07 -3.95 -3.80 -12.81 -13.30]
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State 282, Action W, Q-values: [-1.16 -1.88 -0.92 -0.37 -9.69 -11.01]
State 283, Action W, Q-values: [-3.65 -3.84 -3.52 -3.19 -10.82 -12.65]
State 284, Action N, Q-values: [-1.59 -0.22 -1.14 -2.05 -9.37 -9.43]
State 285, Action W, Q-values: [+3.21 +3.10 +2.83 +3.24 -4.16 -2.83]
State 286, Action N, Q-values: [-1.79 -0.48 -1.58 -2.21 -9.58 -8.44]
State 287, Action N, Q-values: [+1.70 +3.19 +2.00 +0.98 -6.50 -6.86]
State 288, Action W, Q-values: [-1.12 -1.14 -0.75 -0.43 -10.01 -10.10]
State 289, Action W, Q-values: [-4.35 -4.06 -4.30 -3.80 -12.59 -13.82]
State 290, Action W, Q-values: [+3.24 +3.10 +2.92 +3.33 -4.16 -2.43]
State 291, Action W, Q-values: [-3.66 -3.74 -3.78 -3.39 -12.09 -12.96]
State 292, Action W, Q-values: [-0.70 -1.55 -1.06 -0.58 -9.85 -10.17]
State 293, Action S, Q-values: [+1.61 +0.16 +0.78 +1.43 -8.83 -8.47]
State 294, Action S, Q-values: [-0.48 -1.12 -0.95 -0.60 -9.14 -9.92]
State 295, Action W, Q-values: [+3.25 +3.09 +2.95 +3.27 -4.12 -2.67]
State 296, Action W, Q-values: [+3.31 +4.03 +3.96 +5.99 -3.45 -4.69]
State 297, Action N, Q-values: [+10.19 +14.45 +12.02 +10.96 +4.37 +4.65]
State 298, Action W, Q-values: [+3.48 +3.88 +4.25 +5.97 -3.31 -4.59]
State 299, Action S, Q-values: [+11.66 +8.77 +9.30 +10.89 +0.36 -0.32]
State 300, Action W, Q-values: [+3.31 +3.12 +2.93 +3.37 -3.92 -2.30]
State 301, Action N, Q-values: [-2.40 -1.31 -2.18 -2.13 -10.70 -10.09]
State 302, Action N, Q-values: [+2.17 +3.18 +2.09 +1.73 -7.53 -7.04]
State 303, Action N, Q-values: [-1.40 -0.29 -1.09 -1.04 -10.55 -10.25]
State 304, Action N, Q-values: [-4.69 -4.35 -4.71 -4.74 -12.42 -13.51]
State 305, Action W, Q-values: [+3.21 +3.05 +2.78 +3.27 -4.17 -2.46]
State 306, Action N, Q-values: [-5.91 -4.18 -5.12 -5.12 -15.82 -16.47]
State 307, Action N, Q-values: [-3.19 -2.08 -2.84 -2.82 -10.15 -10.83]
State 308, Action S, Q-values: [+5.65 +3.67 +4.32 +4.64 -3.94 -3.72]
State 309, Action S, Q-values: [+0.51 -0.97 +0.17 +0.09 -9.41 -8.22]
State 310, Action W, Q-values: [+3.26 +3.15 +2.89 +3.34 -4.26 -2.96]
State 311, Action S, Q-values: [+1.60 +0.47 +0.80 +0.91 -6.18 -6.87]
State 312, Action N, Q-values: [-4.30 -2.98 -3.78 -3.94 -12.15 -12.25]
State 313, Action N, Q-values: [-2.53 -1.47 -2.01 -2.18 -10.41 -10.29]
State 314, Action N, Q-values: [-4.31 -3.02 -3.79 -3.72 -12.44 -12.10]
State 315, Action W, Q-values: [+3.26 +3.22 +2.99 +3.38 -4.43 -2.96]
State 316, Action N, Q-values: [+8.07 +11.95 +9.60 +9.28 +3.66 +2.92]
State 317, Action N, Q-values: [+1.58 +4.53 +4.05 +2.28 -5.47 -5.40]
State 318, Action S, Q-values: [+17.00 +11.69 +13.48 +14.45 +5.07 +7.45]
State 319, Action N, Q-values: [+3.20 +6.24 +4.83 +4.33 -3.75 -3.18]
State 320, Action W, Q-values: [+3.17 +3.05 +2.88 +3.23 -4.23 -2.73]
State 321, Action N, Q-values: [-3.30 -2.09 -3.18 -2.94 -10.65 -11.29]
State 322, Action N, Q-values: [+0.30 +1.65 +0.16 +0.99 -8.18 -8.77]
State 323, Action N, Q-values: [-2.39 -1.30 -2.43 -2.19 -9.95 -10.09]
State 324, Action N, Q-values: [-4.04 -3.61 -3.63 -4.08 -12.29 -12.37]
State 325, Action S, Q-values: [+3.36 +3.24 +2.92 +3.34 -4.18 -2.74]
State 326, Action E, Q-values: [-4.03 -3.72 -3.61 -4.21 -12.99 -13.00]
State 327, Action N, Q-values: [-2.61 -1.45 -1.97 -2.18 -10.17 -10.79]
State 328, Action N, Q-values: [+0.57 +1.68 +0.35 +1.00 -9.07 -8.83]
State 329, Action N, Q-values: [-3.35 -2.20 -3.27 -3.05 -8.96 -11.17]
State 330, Action W, Q-values: [+2.94 +2.80 +2.58 +2.99 -4.41 -3.23]
State 331, Action N, Q-values: [-2.37 -1.35 -2.18 -1.97 -9.65 -9.67]
State 332, Action N, Q-values: [-2.66 -2.18 -2.24 -2.69 -10.06 -10.60]
State 333, Action N, Q-values: [-1.94 -0.45 -0.47 -1.40 -10.24 -9.87]
State 334, Action N, Q-values: [-3.50 -2.28 -2.69 -2.97 -11.27 -11.57]
State 335, Action S, Q-values: [+3.23 +3.10 +2.79 +3.20 -4.49 -2.70]
State 336, Action N, Q-values: [+6.53 +9.96 +6.59 +8.95 +0.92 +0.21]
State 337, Action N, Q-values: [+3.89 +6.22 +5.46 +4.28 -4.37 -2.39]
State 338, Action N, Q-values: [+6.71 +9.43 +6.87 +8.06 -0.55 +0.45]
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State 339, Action N, Q-values: [+5.44 +7.71 +7.07 +5.97 -2.70 -0.55]
State 340, Action W, Q-values: [+3.24 +2.96 +2.86 +3.24 -4.16 -2.93]
State 341, Action N, Q-values: [-3.44 -2.96 -3.46 -3.17 -10.32 -11.60]
State 342, Action N, Q-values: [-0.39 +0.62 -0.09 +0.45 -9.71 -8.94]
State 343, Action N, Q-values: [-3.32 -2.13 -2.79 -2.25 -11.24 -11.40]
State 344, Action N, Q-values: [-4.07 -2.87 -3.59 -3.90 -11.24 -11.66]
State 345, Action S, Q-values: [+3.22 +2.97 +2.78 +3.19 -4.16 -2.62]
State 346, Action N, Q-values: [-4.22 -3.02 -3.58 -3.88 -11.53 -11.49]
State 347, Action N, Q-values: [-1.81 -0.24 -1.06 -2.01 -9.91 -10.24]
State 348, Action N, Q-values: [-0.94 +0.35 -0.57 +0.03 -9.55 -9.51]
State 349, Action N, Q-values: [-4.11 -2.91 -3.66 -3.11 -11.28 -11.08]
State 350, Action S, Q-values: [+3.24 +2.93 +2.72 +3.18 -4.10 -2.87]
State 351, Action N, Q-values: [-3.38 -2.17 -3.00 -2.78 -11.51 -11.20]
State 352, Action N, Q-values: [-2.54 -1.35 -2.13 -2.44 -9.99 -10.12]
State 353, Action N, Q-values: [-0.37 +0.70 +0.01 -0.81 -8.56 -8.58]
State 354, Action N, Q-values: [-2.63 -1.41 -2.12 -2.39 -9.87 -10.34]
State 355, Action W, Q-values: [+3.28 +3.14 +2.85 +3.30 -4.31 -2.74]
State 356, Action W, Q-values: [+5.79 +7.40 +5.73 +7.86 -1.92 -2.26]
State 357, Action N, Q-values: [+5.17 +7.17 +6.10 +4.94 -2.36 -1.65]
State 358, Action N, Q-values: [+5.12 +7.38 +5.64 +6.78 -2.88 -1.49]
State 359, Action N, Q-values: [+6.84 +9.39 +8.24 +7.01 +0.10 +0.89]
State 360, Action W, Q-values: [+2.92 +2.79 +2.51 +2.98 -4.50 -3.05]
State 361, Action N, Q-values: [-5.07 -3.57 -4.57 -4.47 -13.98 -14.04]
State 362, Action N, Q-values: [-1.40 -0.40 -1.24 -1.10 -9.78 -9.50]
State 363, Action N, Q-values: [-4.12 -2.90 -3.70 -3.73 -12.02 -11.56]
State 364, Action N, Q-values: [-3.26 -2.10 -2.54 -2.74 -11.16 -11.12]
State 365, Action W, Q-values: [+3.39 +3.34 +3.03 +3.44 -4.21 -2.69]
State 366, Action E, Q-values: [-2.39 -2.22 -2.21 -2.40 -9.82 -10.52]
State 367, Action N, Q-values: [-0.62 +0.78 +0.57 -0.34 -10.32 -8.97]
State 368, Action N, Q-values: [-1.39 -0.34 -1.29 -0.99 -9.21 -9.02]
State 369, Action N, Q-values: [-5.03 -3.62 -4.53 -4.49 -13.19 -13.53]
State 370, Action W, Q-values: [+3.25 +3.16 +2.86 +3.28 -4.27 -2.84]
State 371, Action N, Q-values: [-4.39 -3.04 -3.95 -3.78 -12.44 -12.38]
State 372, Action S, Q-values: [+1.48 +0.37 +0.28 +0.88 -6.52 -6.26]
State 373, Action S, Q-values: [+4.20 +2.33 +2.31 +3.03 -5.48 -5.23]
State 374, Action S, Q-values: [+1.61 +0.29 -0.21 +0.78 -6.77 -7.57]
State 375, Action W, Q-values: [+3.30 +3.11 +2.94 +3.31 -4.37 -2.62]
State 376, Action N, Q-values: [+2.83 +6.24 +3.82 +4.56 -2.51 -3.60]
State 377, Action N, Q-values: [+6.85 +10.01 +9.70 +7.36 +0.87 +0.87]
State 378, Action N, Q-values: [+3.12 +6.19 +3.97 +4.52 -1.63 -3.01]
State 379, Action S, Q-values: [+16.86 +11.83 +11.59 +14.13 +4.44 +7.53]
State 380, Action W, Q-values: [+3.31 +3.17 +2.97 +3.36 -4.27 -2.34]
State 381, Action N, Q-values: [-5.11 -4.29 -5.07 -4.71 -13.95 -14.93]
State 382, Action N, Q-values: [-1.82 -1.44 -1.83 -1.55 -10.01 -11.07]
State 383, Action N, Q-values: [-4.80 -3.73 -4.63 -4.50 -13.00 -13.90]
State 384, Action N, Q-values: [-2.52 -1.30 -2.01 -2.53 -10.94 -10.98]
State 385, Action S, Q-values: [+2.97 +2.79 +2.55 +2.95 -4.49 -3.27]
State 386, Action N, Q-values: [-2.49 -1.39 -2.22 -2.67 -10.76 -10.51]
State 387, Action N, Q-values: [+0.30 +1.81 +0.81 -0.34 -8.48 -7.36]
State 388, Action N, Q-values: [-2.56 -1.42 -2.16 -1.53 -10.31 -10.94]
State 389, Action W, Q-values: [-4.95 -4.46 -4.68 -4.45 -14.24 -14.44]
State 390, Action W, Q-values: [+3.09 +2.92 +2.69 +3.16 -4.50 -3.19]
State 391, Action N, Q-values: [-4.12 -3.80 -4.25 -3.93 -11.45 -12.47]
State 392, Action W, Q-values: [+0.52 -0.85 -0.21 +0.59 -8.50 -9.45]
State 393, Action W, Q-values: [+2.83 +1.05 +2.43 +2.84 -7.29 -7.72]
State 394, Action W, Q-values: [+0.48 -0.61 -0.06 +0.55 -8.52 -9.49]
State 395, Action W, Q-values: [+3.00 +2.94 +2.69 +3.04 -4.32 -3.12]
```

```
State 396, Action W, Q-values: [+3.19 +4.04 +3.33 +4.42 -5.32 -5.35]
State 397, Action N, Q-values: [+8.07 +12.01 +9.76 +8.92 +3.78 +3.63]
State 398, Action N, Q-values: [+2.85 +4.45 +3.10 +3.68 -6.08 -4.48]
State 399, Action S, Q-values: [+14.18 +9.82 +11.34 +13.28 +2.69 +3.27]
State 400, Action W, Q-values: [+3.19 +2.97 +2.84 +3.25 -4.38 -3.28]
State 401, Action N, Q-values: [-2.55 -2.28 -2.61 -2.69 -10.51 -11.25]
State 402, Action N, Q-values: [+0.57 +1.52 +0.55 +0.58 -8.87 -8.43]
State 403, Action N, Q-values: [-2.31 -1.49 -2.13 -2.02 -10.77 -11.69]
State 404, Action N, Q-values: [-5.29 -4.79 -5.20 -5.24 -14.50 -15.63]
State 405, Action W, Q-values: [+3.19 +3.07 +2.87 +3.27 -4.17 -3.15]
State 406, Action N, Q-values: [-5.51 -4.80 -5.43 -5.66 -15.57 -16.00]
State 407, Action N, Q-values: [-3.55 -2.96 -3.59 -3.78 -11.07 -11.58]
State 408, Action P, Q-values: [+5.86 +5.24 +5.00 +6.06 +7.58 -2.99]
State 409, Action P, Q-values: [+0.65 -0.25 +0.82 +0.71 +1.66 -6.32]
State 410, Action W, Q-values: [+3.21 +2.98 +2.77 +3.21 -4.39 -3.06]
State 411, Action P, Q-values: [+2.03 +0.61 +1.78 +1.83 +2.91 -6.82]
State 412, Action N, Q-values: [-4.20 -3.69 -4.17 -4.48 -12.72 -12.96]
State 413, Action N, Q-values: [-2.88 -2.52 -2.97 -3.03 -10.35 -11.77]
State 414, Action N, Q-values: [-4.27 -3.82 -4.32 -4.28 -12.14 -13.08]
State 415, Action W, Q-values: [+3.26 +3.15 +2.89 +3.41 -4.37 -2.39]
State 416, Action N, Q-values: [+8.20 +9.78 +7.96 +8.73 +2.06 +6.61]
State 417, Action N, Q-values: [+1.76 +3.13 +2.53 +1.61 -6.38 -0.44]
State 418, Action D, Q-values: [+16.88 +14.06 +15.74 +16.46 +8.15 +19.86]
State 419, Action N, Q-values: [+3.05 +4.52 +3.86 +3.36 -4.87 +0.09]
State 420, Action W, Q-values: [+3.32 +3.23 +2.92 +3.35 -4.18 -2.27]
State 421, Action N, Q-values: [-3.56 -2.89 -3.76 -3.64 -11.29 -12.15]
State 422, Action N, Q-values: [-0.44 +0.50 -0.38 -0.25 -9.13 -9.31]
State 423, Action N, Q-values: [-2.71 -2.29 -3.06 -2.83 -11.43 -11.73]
State 424, Action E, Q-values: [-4.64 -4.37 -4.37 -4.71 -13.31 -13.52]
State 425, Action W, Q-values: [+3.22 +3.11 +2.85 +3.23 -4.24 -2.42]
State 426, Action E, Q-values: [-4.61 -4.30 -4.22 -4.80 -14.22 -13.71]
State 427, Action E, Q-values: [-2.85 -2.47 -2.18 -2.61 -11.16 -12.26]
State 428, Action N, Q-values: [+0.20 +0.99 +0.07 +0.31 -8.96 -9.27]
State 429, Action N, Q-values: [-3.46 -3.03 -3.73 -3.57 -9.68 -11.79]
State 430, Action S, Q-values: [+3.26 +3.13 +2.80 +3.25 -4.19 -2.63]
State 431, Action N, Q-values: [-3.55 -2.21 -3.46 -3.38 -12.19 -11.73]
State 432, Action N, Q-values: [-3.25 -2.90 -3.17 -3.36 -10.38 -11.42]
State 433, Action E, Q-values: [-1.80 -1.59 -1.54 -1.79 -10.26 -10.39]
State 434, Action E, Q-values: [-3.60 -3.31 -3.10 -3.56 -10.07 -12.80]
State 435, Action W, Q-values: [+3.31 +3.01 +2.96 +3.37 -4.16 -2.50]
State 436, Action N, Q-values: [+4.93 +5.82 +4.34 +4.95 -3.49 -1.99]
State 437, Action N, Q-values: [+3.90 +4.25 +3.96 +4.00 -4.89 -3.54]
State 438, Action N, Q-values: [+5.52 +6.87 +4.97 +5.53 -3.12 -1.88]
State 439, Action N, Q-values: [+4.36 +5.01 +4.47 +4.45 -4.70 -2.88]
State 440, Action W, Q-values: [+3.21 +3.08 +2.87 +3.26 -4.49 -2.83]
State 441, Action N, Q-values: [-4.31 -3.67 -4.48 -4.13 -11.67 -13.41]
State 442, Action N, Q-values: [-1.12 -0.36 -1.39 -0.67 -9.40 -11.27]
State 443, Action N, Q-values: [-3.36 -2.86 -3.41 -3.42 -9.61 -12.41]
State 444, Action N, Q-values: [-3.89 -3.53 -3.77 -3.99 -11.92 -12.25]
State 445, Action W, Q-values: [+3.27 +3.12 +2.93 +3.37 -3.98 -2.50]
State 446, Action N, Q-values: [-4.14 -3.75 -3.97 -4.20 -12.62 -12.52]
State 447, Action N, Q-values: [-1.70 -1.30 -1.83 -2.07 -9.71 -10.14]
State 448, Action N, Q-values: [-1.37 -0.49 -1.12 -0.62 -9.90 -11.04]
State 449, Action N, Q-values: [-3.90 -3.66 -3.86 -3.90 -11.74 -12.90]
State 450, Action W, Q-values: [+3.30 +3.03 +2.85 +3.33 -4.34 -3.01]
State 451, Action N, Q-values: [-3.42 -3.07 -3.31 -3.17 -10.65 -12.07]
State 452, Action N, Q-values: [-2.53 -2.19 -2.55 -3.10 -10.03 -11.03]
```

```
State 453, Action N, Q-values: [−1.57 −0.48 −1.16 −1.59 −10.51 −10.23]
State 454, Action N, Q-values: [−2.79 −2.35 −2.77 −3.04 −10.69 −11.05]
State 455, Action W, Q-values: [+3.27 +3.28 +2.94 +3.45 −4.18 −2.66]
State 456, Action N, Q-values: [+5.11 +6.11 +4.91 +5.65 −3.50 −2.14]
State 457, Action N, Q-values: [+4.50 +5.45 +4.39 +4.24 −3.43 −2.18]
State 458, Action N, Q-values: [+5.04 +6.16 +4.98 +5.47 −3.62 −2.27]
State 459, Action N, Q-values: [+5.64 +6.73 +5.67 +5.22 −2.59 −0.86]
State 460, Action W, Q-values: [+3.12 +3.10 +2.87 +3.14 −4.34 −2.82]
State 461, Action N, Q-values: [−4.67 −4.29 −4.63 −4.65 −14.32 −13.95]
State 462, Action N, Q-values: [−1.90 −1.28 −1.94 −1.87 −9.41 −10.60]
State 463, Action N, Q-values: [−3.96 −3.58 −4.07 −4.07 −12.15 −12.67]
State 464, Action E, Q-values: [−3.25 −3.15 −2.97 −3.36 −11.72 −12.03]
State 465, Action W, Q-values: [+3.43 +3.37 +3.04 +3.48 −4.16 −2.35]
State 466, Action N, Q-values: [−3.42 −2.94 −3.35 −3.48 −9.93 −12.77]
State 467, Action E, Q-values: [−1.43 −0.60 −0.52 −1.44 −9.96 −10.79]
State 468, Action N, Q-values: [−1.81 −1.35 −1.97 −1.75 −9.10 −10.90]
State 469, Action N, Q-values: [−4.97 −4.38 −5.12 −5.24 −14.52 −14.93]
State 470, Action W, Q-values: [+3.17 +2.97 +2.83 +3.19 −4.28 −2.78]
State 471, Action N, Q-values: [−4.26 −3.76 −4.28 −4.29 −13.32 −12.74]
State 472, Action P, Q-values: [+2.14 +0.46 +1.19 +1.72 +2.82 −6.17]
State 473, Action P, Q-values: [+4.06 +3.18 +2.79 +4.17 +5.87 −2.68]
State 474, Action P, Q-values: [+2.01 +0.72 +1.15 +1.79 +2.92 −6.66]
State 475, Action W, Q-values: [+2.96 +2.75 +2.54 +2.96 −4.54 −3.28]
State 476, Action N, Q-values: [+3.53 +4.63 +3.21 +3.73 −4.79 +1.65]
State 477, Action N, Q-values: [+5.70 +7.94 +7.66 +5.64 −2.25 +2.76]
State 478, Action N, Q-values: [+3.06 +4.34 +2.21 +3.46 −4.78 +0.70]
State 479, Action D, Q-values: [+16.57 +14.00 +13.92 +16.19 +8.46 +19.98]
State 480, Action W, Q-values: [+3.38 +3.21 +3.01 +3.41 −3.98 −2.65]
State 481, Action N, Q-values: [−5.37 −4.94 −5.46 −5.08 −15.69 −15.89]
State 482, Action N, Q-values: [−2.80 −2.31 −2.70 −2.43 −11.02 −11.74]
State 483, Action N, Q-values: [−4.65 −4.26 −4.63 −4.37 −13.65 −13.84]
State 484, Action N, Q-values: [−2.95 −2.20 −3.06 −3.50 −9.53 −11.32]
State 485, Action W, Q-values: [+3.14 +3.00 +2.78 +3.30 −4.37 −2.72]
State 486, Action N, Q-values: [−2.99 −2.38 −2.98 −2.99 −10.65 −11.04]
State 487, Action N, Q-values: [−0.30 +0.60 −0.06 −0.39 −10.27 −8.74]
State 488, Action N, Q-values: [−2.71 −2.18 −2.81 −2.92 −8.73 −11.20]
State 489, Action N, Q-values: [−5.40 −4.90 −5.42 −5.25 −15.85 −16.12]
State 490, Action W, Q-values: [+3.25 +2.94 +2.86 +3.26 −4.32 −2.65]
State 491, Action N, Q-values: [−4.85 −4.30 −4.80 −4.52 −13.56 −14.63]
State 492, Action W, Q-values: [+0.43 −0.11 +0.91 +1.54 −7.89 −9.86]
State 493, Action W, Q-values: [+3.92 +1.85 +3.77 +4.37 −5.95 −7.14]
State 494, Action W, Q-values: [+0.47 −0.35 +0.88 +1.62 −8.22 −9.27]
State 495, Action W, Q-values: [+3.20 +3.10 +2.82 +3.24 −4.33 −2.87]
State 496, Action N, Q-values: [+2.76 +3.34 +2.51 +3.17 −6.45 −4.86]
State 497, Action N, Q-values: [+7.78 +9.83 +8.69 +6.94 +0.83 +1.58]
State 498, Action W, Q-values: [+2.57 +2.67 +2.14 +2.77 −6.54 −5.77]
State 499, Action W, Q-values: [+14.52 +13.11 +13.96 +16.88 +5.54 +7.03]
episodes: 0, acton: 3, state: 128
episodes: 0, acton: 0, state: 108
episodes: 0, acton: 0, state: 208
episodes: 0, acton: 0, state: 308
episodes: 0, acton: 4, state: 408
episodes: 0, acton: 1, state: 416
episodes: 0, acton: 1, state: 316
episodes: 0, acton: 1, state: 216
episodes: 0, acton: 1, state: 116
episodes: 0, acton: 5, state: 16
```

```
Episode 1: Total Reward = 11
episodes: 1, acton: 1, state: 406
episodes: 1, acton: 1, state: 306
episodes: 1, acton: 2, state: 206
episodes: 1, acton: 2, state: 226
episodes: 1, acton: 1, state: 246
episodes: 1, acton: 1, state: 146
episodes: 1, acton: 2, state: 46
episodes: 1, acton: 2, state: 66
episodes: 1, acton: 4, state: 86
episodes: 1, acton: 0, state: 98
episodes: 1, acton: 0, state: 198
episodes: 1, acton: 3, state: 298
episodes: 1, acton: 3, state: 278
episodes: 1, acton: 3, state: 258
episodes: 1, acton: 3, state: 238
episodes: 1, acton: 0, state: 218
episodes: 1, acton: 0, state: 318
episodes: 1, acton: 5, state: 418
Episode 2: Total Reward = 3
episodes: 2, acton: 0, state: 142
episodes: 2, acton: 3, state: 242
episodes: 2, acton: 1, state: 222
episodes: 2, acton: 1, state: 122
episodes: 2, acton: 3, state: 22
episodes: 2, acton: 4, state: 2
episodes: 2, acton: 0, state: 18
episodes: 2, acton: 0, state: 118
episodes: 2, acton: 0, state: 218
episodes: 2, acton: 0, state: 318
episodes: 2, acton: 5, state: 418
Episode 3: Total Reward = 10
episodes: 3, acton: 3, state: 261
episodes: 3, acton: 3, state: 241
episodes: 3, acton: 1, state: 221
episodes: 3, acton: 1, state: 121
episodes: 3, acton: 3, state: 21
episodes: 3, acton: 4, state: 1
episodes: 3, acton: 2, state: 17
episodes: 3, acton: 0, state: 37
episodes: 3, acton: 0, state: 137
episodes: 3, acton: 2, state: 237
episodes: 3, acton: 1, state: 257
episodes: 3, acton: 1, state: 157
episodes: 3, acton: 2, state: 57
episodes: 3, acton: 2, state: 77
episodes: 3, acton: 5, state: 97
Episode 4: Total Reward = 6
episodes: 4, acton: 1, state: 412
episodes: 4, acton: 1, state: 312
episodes: 4, acton: 2, state: 212
episodes: 4, acton: 2, state: 232
episodes: 4, acton: 2, state: 252
episodes: 4, acton: 0, state: 272
episodes: 4, acton: 0, state: 372
episodes: 4, acton: 4, state: 472
episodes: 4, acton: 1, state: 476
```

```
episodes: 4, acton: 1, state: 376
episodes: 4, acton: 3, state: 276
episodes: 4, acton: 3, state: 256
episodes: 4, acton: 1, state: 236
episodes: 4, acton: 1, state: 136
episodes: 4, acton: 3, state: 36
episodes: 4, acton: 5, state: 16
Episode 5: Total Reward = 5
Saving gif...Done!
Average Reward across all Episodes: = 7.0
```

In [144...
```python
# display the captured GIF
display.Image(data=open("./gifs/taxi_dqn_fine_tuned.gif",'rb').read(), fo
# "taxi_dqn_fine_tuned"
```

Out[144... `<IPython.core.display.Image object>`

If the above display function is not working, here is the previously prepared taxi_dqn_fine_tuned.gif
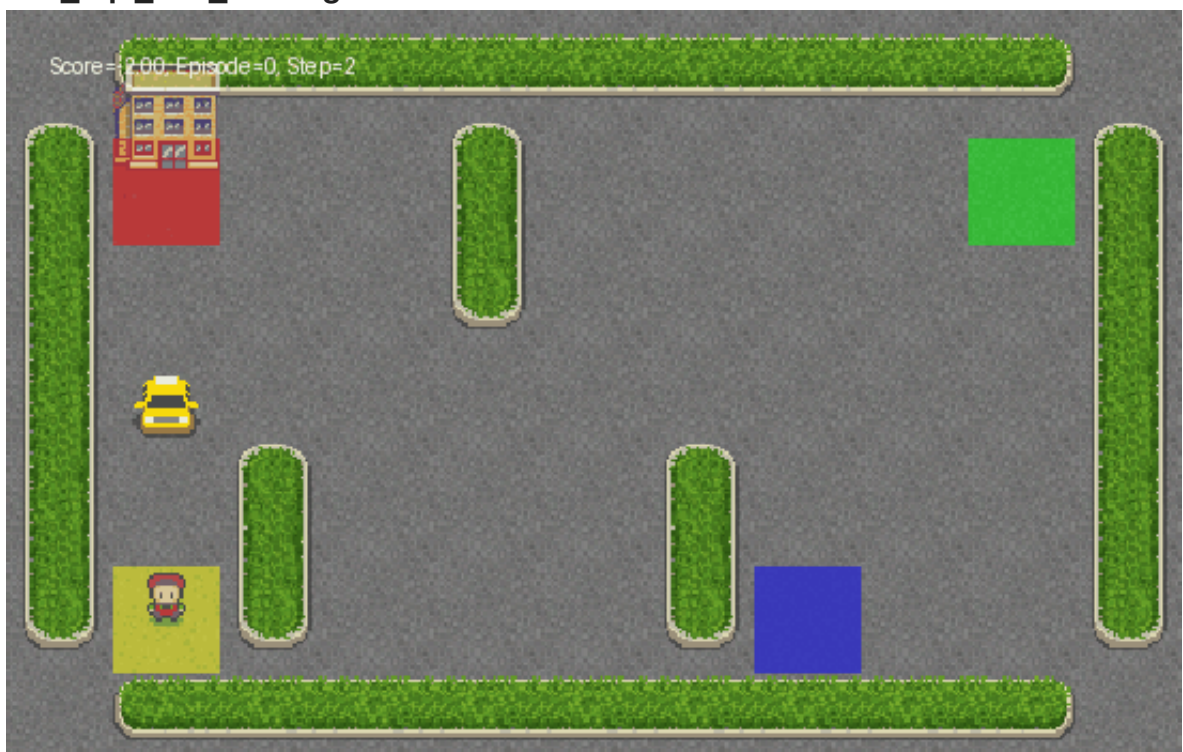
Compare the prediction of fine tuned models

In [155...
```python
# my_q_agent_fine_tuned_avg_reward_lst )
# my_dqn_agent_fine_tuned_avg_reward_lst)
```

In [149...
```python
x = range(1,1000 + 1)

plt.figure(figsize=(10, 6))
plt.plot(x, my_dqn_agent_fine_tuned_avg_reward_lst, label='DQN', marker='
plt.plot(x, my_q_agent_fine_tuned_avg_reward_lst , label='Q-learning', ma

# titles and labels
plt.title('Prediction Comparison (Fine Tuned Unique Parameters)')
```

```
plt.xlabel('Time Episodes')
plt.ylabel('Average Reward')
plt.legend()
# display
plt.grid(True)
plt.show()
```


Prediction Comparison (Fine Tuned Unique Parameters)
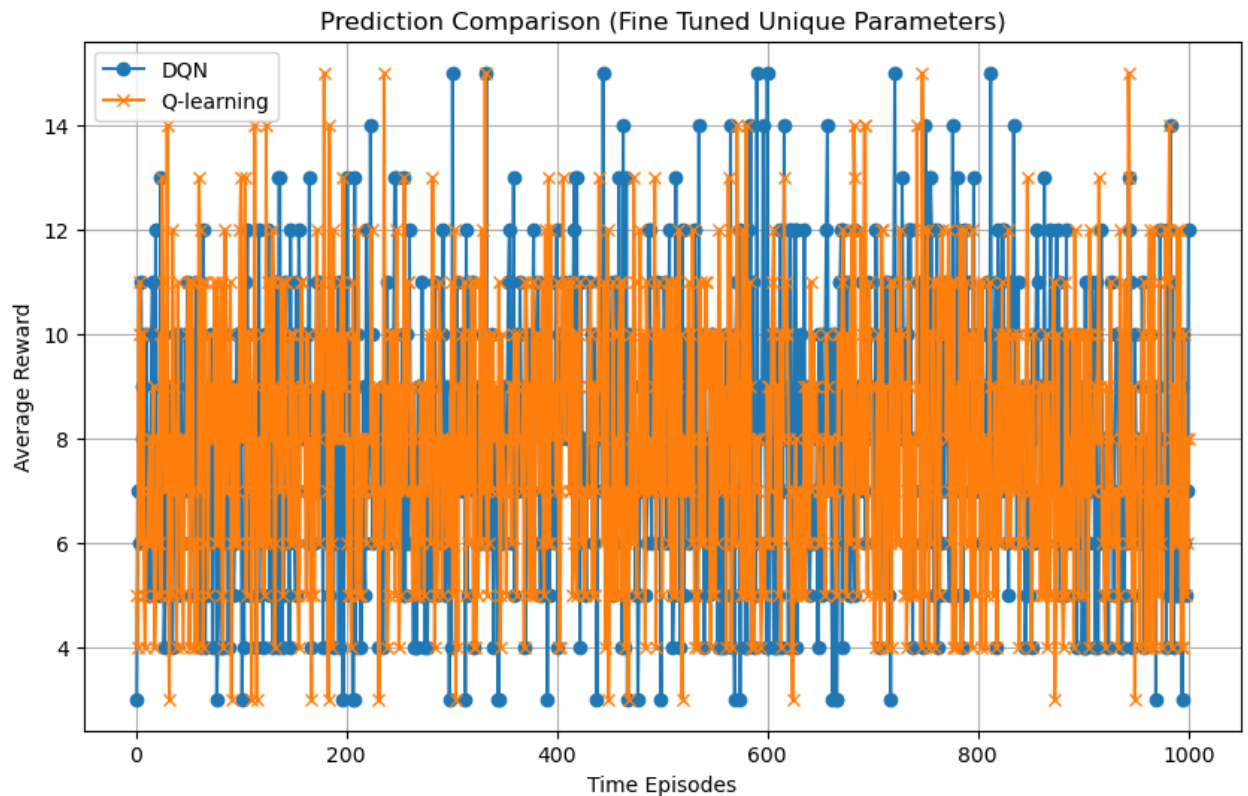
Discussion

Controlled Parameters Limitations in Training and Performance
The initial approach of using controlled parameters for both Q-learning and Deep Q-Network (DQN) algorithms showed significant differences in learning patterns and performance. Q-learning demonstrated rapid improvement during the early episodes of the training phase, converging to an average score of 7-8 after around 5,000 episodes. This quick convergence highlights the fact that Q-learning is rather efficient in this Taxi game environment.

However, it is important to note that a one-to-one direct comparison using controlled parameters for both algorithms is not a good idea at all. The learning rate α and discount factor γ impact Q-learning and DQN differently, probably due to their design difference. Especially, DQN has additional parameters such as network synchronization rate τ, batch size, and the neural network's weights and biases, which have no counterparts in the traditional Q-learning algorithm.

There is drastic difference between the performance of Q-learning and DQN with the controlled parameters $\alpha = 0.5, \gamma = 0.95$. DQN showed a gradual improvement up to 50,000 episodes but then plateaued at around -200 average reward which is significantly underperforming if compared to Q-learning. This stagnation in DQN

training and performance suggests that the selected values might be suitable for Q-learning but only suboptimal for DQN.

Optimized Performance through Unique Parameter Tuning
Q-learning and DQN show more promising result with manually fine-tuned unique parameters. With the tailored parameters, both Q-learning and DQN optimized to similar performance levels, converging to an average score of 7-8 over 1,000 test runs.

Q-learning shows a rapid learning curve just like before, stabilizing at the optimal performance level after approximately 5,000 training episodes.

DQN, in contrast, when properly fine-tuned, exhibited a different learning trajectory than before. DQN initially varies in its average training score but began to improve significantly after 10,000 episodes. The DQN algorithm gradually converged toward higher scores, eventually matching Q-learning's performance after about 75,000 episodes of training.

A few highlights:

- Algorithm specific parameters matter for performance (controlled parameters comparison simply does not work)
- Under the Taxi environment, DQN and Q-learning can be on par in performance when given sufficient and appropriate training time, episodes, and parameters
- Q-learning's rapid convergence shows a great fit for small environment like Taxi game and DQN properly has more potential in handling more complex environments

Conclusion

Convergence
Q-learning demonstrated consistent convergence to an optimal policy which align with its theoretical design. In contrast, DQN, by the nature of its design, does not necessarily guarantee convergence to an optimal policy. Despite that, our fine-tuned DQN model achieved performance on par with Q-learning in the Taxi environment. That is, DQN can provide a "good enough" policy for prediction.

Small-Scale Environments

For problem with limited action and observation spaces, such as the Taxi game, the performance difference between Q-learning and DQN was minimal. This result suggests that, perhaps in a Discrete environment the added complexity of DQN is probably not advantages. Where the Q-learning, which guarantees optimal policy, should be a better tool of choice.

Efficiency

Q-learning exhibited rapid convergence within thousands of episodes in the training phase. DQN, while capable of reaching similar performance as Q-learning eventually, required substantially more episodes and computational resources. The difference in efficiency is an important consideration for applications, especially in resource-constrained situations.

Setting a Benchmark

The project highlighted the need for more robust benchmarking methodology to compare the performance of the reinforcement learning models. Data Structure and Algorithmic Analysis can always rely on metric like the Big O notation for performance comparison. In contrast, the reinforcement learning performance comparison in this project lacks some kind of standard metric as the performance can be influenced by various factors, including hardware specifications, system load, and even environmental conditions. Further study in reinforcement learning is needed in order to learn how to utilize standardized metrics to measure the models.

Potential Improvement

I think there are still room for me to improve and optimize the Q-learning and DQN implementations and comparison. Maybe like fine-tuning hyperparameters, optimizing network architecture for DQN, and exploring different network synchronization values and strategies. Also, testing the algorithms on multiple Gymnasium environment, for example, compare between Discrete Space and Continuous Space. Or to put the algorithms to test and compare between different games of Discrete space like Taxi game vs Cliff walking. Further, the algorithms can also be tested in a more complex environment, like a bigger and more complex map for the Taxi agent to perform in.

Final Thoughts
Overall, I found the project to be interesting, challenging yet rewarding, especially when I get to see the Taxi agent navigating its way through the map and picking-up/dropping-off the passenger correctly.

Reference: Please include all relevant links (git, video, etc)

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