Assignment4 (1)

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1 IDS 576: Assignment 4

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1.0.1 1. Bandits and RL (2pt)

The following questions do not involve programming. You can use the markdown option for cells in Jupyter notebook to answer.

- What is the difference between A/B testing and Multi-armed bandits?

A/B testing shows a group A(control) and a group B(treatment) 2 solutions and figures out if solution A is different than solution B, while Multi-armed bandit problems dynamically changes who sees what treatment.

- What is the role of exploration in the Bandit problems?

We need to explore different arms (choices) to then evaluate the performance of each strategy. This exploration will allow the agent to improve its knowledge about each action which will then lead to a long-term benefit.

- What is the difference between the UCB and the Thompson sampling methods in terms of exploration?

Upper Confidence Bound (UCB) can be understood as a form of directed exploration without any random component while the Thompson sampling is considered a more sophisticated form of random exploration. The Thompson sampling draws random values from the posterior and then greedily chooses with respect to these random values, so the agent will explore more as it is more uncertain.

- How does the contextual setting differ from the non-contextual setting in terms of difficulty (be precise)?

In Multi-armed bandits MAB without context the goal was to find a single best action while in the contextual setting the problem has a context at every round, the goal is to find what is the best thing to do in each context and we may not see the same context twice. Thus, the difficulty increases greatly when the MAB is contextual.

- Can bandit algorithms be used for contextual bandits setting? If so, what is the disadvantage?

Yes, there is work that shows that bandit algorithms can be adapted to online contextual bandits scenarios such as *Adapting multi-armed bandits policies to contextual bandits scenarios.* The disadvantage is the computational complexity.

- What is the difference between a Markov Reward Process and a Markov Decision Process? Can Bellman Expectation Equation be applied to both?

The difference is that a Markov Decision Process (MDP) involves making decisions, while a Markov Reward Process (MRP) does not. A MRP is a Markov chain with values, an associated reward function, and arises when we fix a policy for a MDP. The Bellman equation can be used in MRPs but it's a fundamental recursive property of MDPs.

- What is the difference between supervised learning and reinforcement learning?

The difference is thar supervised learning has 2 main tasks, Regression and Classification, while reinforcement learning has different tasks such as exploitation, exploration, Markov Decision Process (MDP), and value learning. Also, reinforcement learning is trained as a learning agent where it works as a reward and action system while supervised learning makes prediction depending on a class type.

- How are simulations used in a forward search? (i.e., in a simple Monte Carlo search)

Given access to a model of the world these methods seek to identify the best action to take based on forward search or simulations. A search tree is built with the current state as the root and the other nodes generated using the model. Such methods can give big savings as we do not need to solve the whole MDP but just the sub MDP starting from the current state.

Gershman S. J. (2018). Deconstructing the human algorithms for exploration. Cognition, 173, 34–42. https://doi.org/10.1016/j.cognition.2017.12.014

1.0.2 2. Bandits (3pt)

Consider a 5-armed stochastic bandit problem with mean rewards of $(0.1, 0.1, 0.1, 0.1, 0.9)$. The arms are Bernoulli. - Write a function that responds with a stochastically generated reward given the arm index as an input. We will use it to test the performance of various algorithms next. - Write individual functions for epsilon-greedy, UCB1 (informally also referred to as UCB) and Thompson sampling (use Beta-Bernoulli conjugacy) from scratch. - For various choices of ϵ, show how epsilon-greedy performs in terms of cumulative expected regret and in terms of arm selection. - Plot multiple simulations of the performance of UCB1 algorithm. - Plot multiple simulations of the performance of Thompson sampling algorithm. Comment on which algorithm is better qualitatively.

[ ]:
```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
from collections import namedtuple
from scipy.stats import beta
```

[ ]:
```
#--------- ALL FUNCTIONS TO BE USED (for part 2 only)--------#

def bernoulli_data(n_simulations, K):
    ctr = np.array([0.1,0.1,0.1,0.1,0.9])
    rewards = np.random.rand(n_simulations, K) < np.tile(ctr, (n_simulations,␣
 ↪1)) #compares random values to ctr array
    return ctr, rewards
```

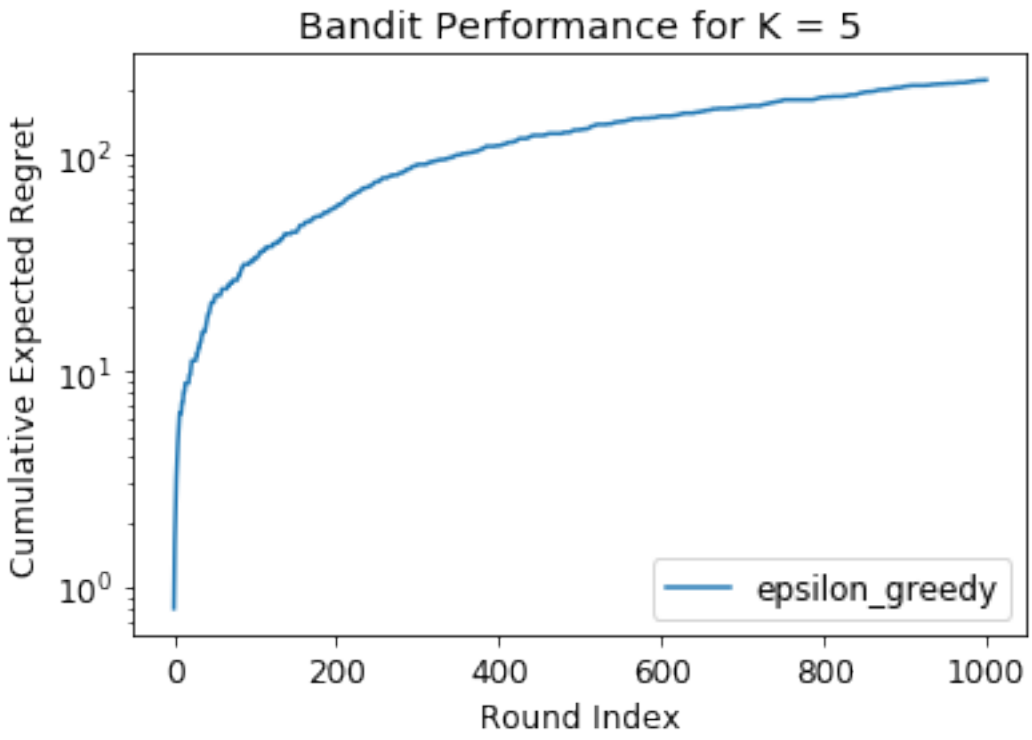
```
def run_bandit_algo(rewards, ctr, algo, **kwargs):
    n_simulations, K = rewards.shape
    counts = np.ones((K, 2), dtype=np.int) #success & failure
    regret = np.zeros(n_simulations)
    max_ctr_count = 0
    max_ctr = np.max(ctr)
    max_ctr_idx = np.argmax(ctr)
    for i in range(n_simulations):
        arm = algo(counts, **kwargs)
        if rewards[i, arm] == 1:
            counts[arm, 0] += 1
        else:
            counts[arm, 1] += 1
        regret[i] = max_ctr - ctr[arm]
        if arm == max_ctr_idx:
            max_ctr_count += 1
    cum_regret = np.cumsum(regret)
    opt_arm_percentage = max_ctr_count / n_simulations
    return cum_regret, opt_arm_percentage

def run_experiments(K, n_simulations, algorithms):
    algo_opt_arm_percentage = []
    algo_cum_regret = np.zeros((n_simulations, len(algorithms)))
    fig = plt.figure(figsize=(6, 4))
    ctr, rewards = bernoulli_data(n_simulations, K)
    for idx, algo in enumerate(algorithms):
        cum_regret, opt_arm_percentage = run_bandit_algo(rewards, ctr,␣
 ↪algo=algo)
        algo_cum_regret[:, idx] = cum_regret
        algo_opt_arm_percentage.append(opt_arm_percentage)
        plt.semilogy(cum_regret, label=algo.__name__)
    plt.title('Bandit Performance for K = {}'.format(K))
    plt.xlabel('Round Index')
    plt.ylabel('Cumulative Expected Regret')
    plt.legend(loc='lower right')
    return ctr, algo_opt_arm_percentage, algo_cum_regret, fig

def epsilon_greedy(counts, epsilon=0.1, decrease_const=1000):
    #counts : K = the total number of arms & 2 = success & failures for each␣
 ↪arm
    # where column 0 represents success, 1 represents failure
    #Returns the chosen arm
    n_arms = counts.shape[0]
    totals = counts.sum(axis=1)
    successes = counts[:, 0]
    empirical_means = successes / totals
```

```
    total_counts = counts.sum()
    epsilon /= (1 + total_counts / decrease_const)
    if np.random.rand() > epsilon:
        return np.argmax(empirical_means)
    else:
        return np.random.randint(0, n_arms)

def ucb(counts):
    totals = counts.sum(axis=1)
    successes = counts[:, 0]
    empirical_means = successes / totals
    total_counts = counts.sum()
    bonus = np.sqrt(2 * np.log(total_counts) / totals)
    return np.argmax(empirical_means + bonus)

class ThompsonSampling:
    def __init__(self, K, prior_params=None):
        if prior_params:
            priors = namedtuple("priors", ["alpha", "beta"])
            prior = [priors(*p) for p in prior_params]
            self.alphas = np.array([p.alpha for p in prior])
            self.betas = np.array([p.beta  for p in prior])
        else:
            self.alphas = np.ones(K)
            self.betas = np.ones(K)
        self.trials = np.zeros(K, dtype=np.int)
        self.success = np.zeros(K, dtype=np.int)

    def get_recommendation(self):
        #construct beta distribution of all arms, draw a random sample from it,
        #return the arm with the maximum value random sample
        theta = np.random.beta(self.alphas + self.success, self.betas + self.
 ↪trials - self.success)
        return np.argmax(theta)

    def update_result(self, arm, converted):
        #this function overrides the trials and success array
        #success array is only updated if it has generated a reward
        self.trials[arm] += 1
        if converted:
            self.success[arm] += 1
        return self

def experiment(T, ctr, prior_params=None):
    K = len(ctr)
    trials = np.zeros((T, K), dtype=np.int)
    success = np.zeros((T, K), dtype=np.int)
```

```
    b_bandit = ThompsonSampling(K, prior_params)
    for t in range(T):
        arm = b_bandit.get_recommendation()
        converted = np.random.rand() < ctr[arm]
        b_bandit.update_result(arm, converted)
        trials[t] = b_bandit.trials
        success[t] = b_bandit.success
    return ctr, trials, success, b_bandit.alphas, b_bandit.betas

def experiment_plot(ctr, trials, success):
    T, K = trials.shape
    n = np.arange(T) + 1
    fig = plt.figure(figsize=(6, 4))
    for i in range(K):
        plt.loglog(n, trials[:, i], label="arm {}".format(i + 1))
    plt.legend(loc="upper left")
    plt.title("Bandit Performance")
    plt.xlabel("Round Index")
    plt.ylabel("Number of turns per arm")
    return fig
```

[ ]:
```
# RUN EPSILON GREEDY with epsilon = 0.5
K = 5
counts = np.ones((K, 2))
epsilon=0.5
n_simulations = 1000
#epsilon_greedy(counts)
algorithms = [epsilon_greedy]
ctr, algo_opt_arm_percentage, algo_cum_regret, fig = run_experiments(K,␣
 ↪n_simulations, algorithms)
print('Results when epsilon = 0.5')
plt.show()
print(ctr)
print('% of simulations that chose the best arm:', algo_opt_arm_percentage)
```

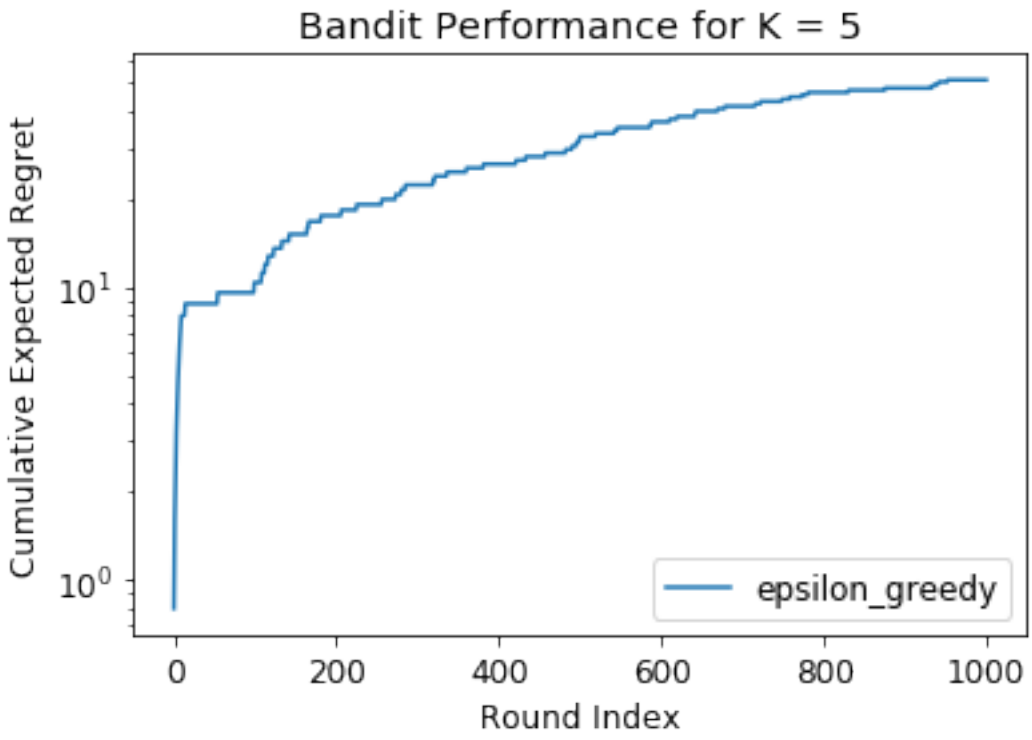
```
Results when epsilon = 0.5
```




```
[0.1 0.1 0.1 0.1 0.9]
Percentage of simulations that chose the best arm [0.722]
```

[ ]:
```
# RUN EPSILON GREEDY with epsilon = 0.1
K = 5
counts = np.ones((K, 2))
epsilon=0.1
n_simulations = 1000
algorithms = [epsilon_greedy]
ctr, algo_opt_arm_percentage, algo_cum_regret, fig = run_experiments(K,␣
 ↪n_simulations, algorithms)
print('Results when epsilon = 0.1')
plt.show()
print(ctr)
print('% of simulations that chose the best arm', algo_opt_arm_percentage)
```

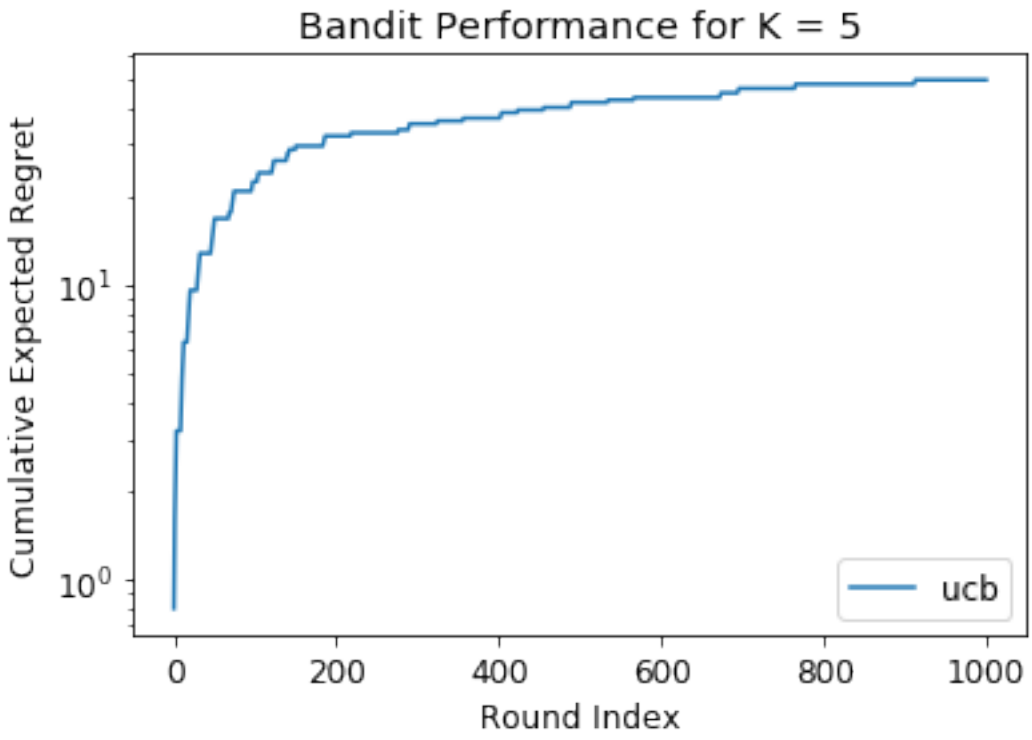
```
Results when epsilon = 0.1
```




```
[0.1 0.1 0.1 0.1 0.9]
% of simulations that chose the best arm [0.936]
```

[ ]:
```
# RUNNING UCB
K = 5
n_simulations = 1000
algorithms = [ucb]
ctr, algo_opt_arm_percentage, algo_cum_regret, fig = run_experiments(K,␣
 ↪n_simulations, algorithms)
print('UCB algorithm')
plt.show()
print(ctr)
print('% of simulations that chose the best arm', algo_opt_arm_percentage)
```

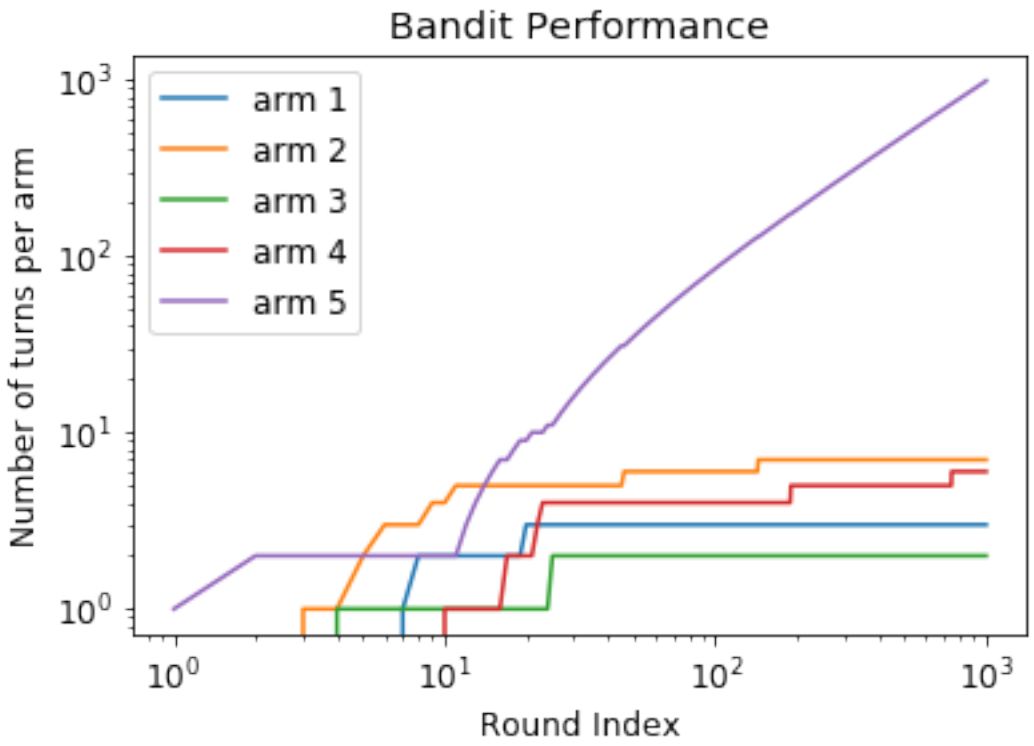
```
UCB algorithm
```




```
[0.1 0.1 0.1 0.1 0.9]
% of simulations that chose the best arm [0.938]
```

[ ]:
```
# RUNNING THOMPSON SAMPLING
T = 1000
ctr = np.array([0.1,0.1,0.1,0.1,0.9])
ctr, trials, success, alphas, betas = experiment(T=T, ctr=ctr)
fig = experiment_plot(ctr, trials, success)
print('Thompson Sampling algorithm')
plt.show()
```

```
Thompson Sampling algorithm
```



From our experiments, we observe that the algorithms converged and that the UCB algorithm seems to be performing better than the greedy algorithm when epsilon is either 0.5 or 0.1 & when round index =1000. As we wanted the expected comulative regret to be the lowest.

Code adapted from:

https://github.com/ankonzoid/LearningX/tree/master/classical_RL/multiarmed_bandit and https://gdmarmerola.github.io/ts-for-bernoulli-bandit/

1.0.3 3. Reinforcement Learning (3pt)

We will use the MIT licensed code to do sensitivity analysis of DQN for the cartpole environment from the `gym` package. You should clone it as needed.

- Describe the state, actions, transitions and rewards for the cartpole environment using the gym package documentation.
- Describe the Q-network used in `dqn.py`. What are the layers and what are the outputs?
- Run the default DQN configuration for cartpole in `dqn.py` and plot the (25,50,75)-percentile reward performance curves over multiple simulations/runs.
- Change the epsilon value (for exploration) to fixed values $\{0.01, 0.1\}$ and plot its impact on learning. Provide an interpretation of the trend observed.
- Change the buffer_limit (of the experience replay buffer) to $\{5000, 10000, 25000\}$ and plot its impact on learning. Provide an interpretation of the trend observed.
- Change gamma (for discounting) to $\{0.75, 0.9\}$ and discuss its impact on on learning. Provide an interpretation of the trend observed.

state : consists of four observables corresponding to position and movements. Cart Position , Cart Velocity, Pole Angle, Pole Velocity At Tip

actions : 0 or 1, pushing the car left or right

transitions: give us the next state s'

rewards: comes from taking action a in state s at time t. A reward of +1 is provided for every timestep that the pole remains upright.

The Qnet class has 3 layers that are linear transformations. The first layer, self.fc1, has 4 in_features and 128 out features. The second layer, self.fc2, has 128 in_features and 128 out features. The last one, self.fc3, has 128 in_features and 2 out features.

[ ]:
```
import gym
import collections
import random

import torch
import torch.nn as nn
import torch.nn.functional as F
import torch.optim as optim
import matplotlib.pyplot as plt
```

[ ]:
```
#DEFAULT DQN CONFIGURATION

#Hyperparameters
learning_rate = 0.0005
gamma         = 0.98
buffer_limit  = 50000
batch_size    = 32

class ReplayBuffer():
    def __init__(self):
        self.buffer = collections.deque(maxlen=buffer_limit)

    def put(self, transition):
        self.buffer.append(transition)

    def sample(self, n):
        mini_batch = random.sample(self.buffer, n)
        s_lst, a_lst, r_lst, s_prime_lst, done_mask_lst = [], [], [], [], []

        for transition in mini_batch:
            s, a, r, s_prime, done_mask = transition
            s_lst.append(s)
            a_lst.append([a])
            r_lst.append([r])
            s_prime_lst.append(s_prime)
```

```
            done_mask_lst.append([done_mask])

        return torch.tensor(s_lst, dtype=torch.float), torch.tensor(a_lst), \
               torch.tensor(r_lst), torch.tensor(s_prime_lst, dtype=torch.
↪float), \
               torch.tensor(done_mask_lst)

    def size(self):
        return len(self.buffer)

class Qnet(nn.Module):
    def __init__(self):
        super(Qnet, self).__init__()
        self.fc1 = nn.Linear(4, 128)
        self.fc2 = nn.Linear(128, 128)
        self.fc3 = nn.Linear(128, 2)

    def forward(self, x):
        x = F.relu(self.fc1(x))
        x = F.relu(self.fc2(x))
        x = self.fc3(x)
        return x

    def sample_action(self, obs, epsilon):
        out = self.forward(obs)
        coin = random.random()
        if coin < epsilon:
            return random.randint(0,1)
        else :
            return out.argmax().item()

def train(q, q_target, memory, optimizer):
    for i in range(10):
        s,a,r,s_prime,done_mask = memory.sample(batch_size)

        q_out = q(s)
        q_a = q_out.gather(1,a)
        max_q_prime = q_target(s_prime).max(1)[0].unsqueeze(1)
        target = r + gamma * max_q_prime * done_mask
        loss = F.smooth_l1_loss(q_a, target)

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


def main():
```

```
    env = gym.make('CartPole-v1')
    q = Qnet()
    q_target = Qnet()
    q_target.load_state_dict(q.state_dict())
    memory = ReplayBuffer()

    print_interval = 20
    score = 0.0
    optimizer = optim.Adam(q.parameters(), lr=learning_rate)
    total_score = []
    list_epsilon = []

    for n_epi in range(10000):
        epsilon = max(0.01, 0.08 - 0.01*(n_epi/200)) #Linear annealing from 8%␣
↪to 1%
        s = env.reset()
        done = False

        while not done:
            a = q.sample_action(torch.from_numpy(s).float(), epsilon)
            s_prime, r, done, info = env.step(a)
            done_mask = 0.0 if done else 1.0
            memory.put((s,a,r/100.0,s_prime, done_mask))
            s = s_prime

            score += r
            if done:
                break

        if memory.size()>2000:
            train(q, q_target, memory, optimizer)

        if n_epi%print_interval==0 and n_epi!=0:
            q_target.load_state_dict(q.state_dict())
            print("n_episode :{}, score : {:.1f}, n_buffer : {}, eps : {:.1f}%".
↪format(
                                                        n_epi, score/
↪print_interval, memory.size(), epsilon*100))

            total_score.append(score)
            list_epsilon.append(epsilon)
            plt.plot(total_score)

            score = 0.0
    env.close()

if __name__ == '__main__':
```

```
    main()
    plt.show()
```

```
n_episode :20, score : 71.8, n_buffer : 1435, eps : 7.9%
n_episode :40, score : 35.0, n_buffer : 2135, eps : 7.8%
n_episode :60, score : 10.3, n_buffer : 2342, eps : 7.7%
n_episode :80, score : 11.1, n_buffer : 2563, eps : 7.6%
n_episode :100, score : 12.8, n_buffer : 2820, eps : 7.5%
n_episode :120, score : 19.2, n_buffer : 3204, eps : 7.4%
n_episode :140, score : 42.8, n_buffer : 4059, eps : 7.3%
n_episode :160, score : 65.0, n_buffer : 5360, eps : 7.2%
n_episode :180, score : 82.8, n_buffer : 7015, eps : 7.1%
n_episode :200, score : 148.3, n_buffer : 9981, eps : 7.0%
n_episode :220, score : 164.2, n_buffer : 13265, eps : 6.9%
n_episode :240, score : 173.2, n_buffer : 16729, eps : 6.8%
n_episode :260, score : 153.9, n_buffer : 19808, eps : 6.7%
n_episode :280, score : 228.8, n_buffer : 24384, eps : 6.6%
n_episode :300, score : 161.6, n_buffer : 27615, eps : 6.5%
n_episode :320, score : 181.8, n_buffer : 31250, eps : 6.4%
n_episode :340, score : 186.3, n_buffer : 34977, eps : 6.3%
n_episode :360, score : 162.1, n_buffer : 38218, eps : 6.2%
n_episode :380, score : 209.7, n_buffer : 42412, eps : 6.1%
n_episode :400, score : 178.9, n_buffer : 45990, eps : 6.0%
n_episode :420, score : 159.2, n_buffer : 49175, eps : 5.9%
n_episode :440, score : 158.2, n_buffer : 50000, eps : 5.8%
n_episode :460, score : 149.7, n_buffer : 50000, eps : 5.7%
n_episode :480, score : 143.4, n_buffer : 50000, eps : 5.6%
n_episode :500, score : 178.7, n_buffer : 50000, eps : 5.5%
n_episode :520, score : 154.1, n_buffer : 50000, eps : 5.4%
n_episode :540, score : 186.3, n_buffer : 50000, eps : 5.3%
n_episode :560, score : 185.9, n_buffer : 50000, eps : 5.2%
n_episode :580, score : 221.0, n_buffer : 50000, eps : 5.1%
n_episode :600, score : 240.8, n_buffer : 50000, eps : 5.0%
n_episode :620, score : 194.6, n_buffer : 50000, eps : 4.9%
n_episode :640, score : 174.2, n_buffer : 50000, eps : 4.8%
n_episode :660, score : 183.0, n_buffer : 50000, eps : 4.7%
n_episode :680, score : 167.5, n_buffer : 50000, eps : 4.6%
n_episode :700, score : 171.3, n_buffer : 50000, eps : 4.5%
n_episode :720, score : 293.1, n_buffer : 50000, eps : 4.4%
n_episode :740, score : 273.8, n_buffer : 50000, eps : 4.3%
n_episode :760, score : 208.6, n_buffer : 50000, eps : 4.2%
n_episode :780, score : 288.9, n_buffer : 50000, eps : 4.1%
n_episode :800, score : 263.1, n_buffer : 50000, eps : 4.0%
n_episode :820, score : 172.0, n_buffer : 50000, eps : 3.9%
n_episode :840, score : 351.9, n_buffer : 50000, eps : 3.8%
n_episode :860, score : 273.1, n_buffer : 50000, eps : 3.7%
n_episode :880, score : 260.1, n_buffer : 50000, eps : 3.6%
```

```
n_episode :900, score : 342.9, n_buffer : 50000, eps : 3.5%
n_episode :920, score : 239.8, n_buffer : 50000, eps : 3.4%
n_episode :940, score : 298.6, n_buffer : 50000, eps : 3.3%
n_episode :960, score : 254.2, n_buffer : 50000, eps : 3.2%
n_episode :980, score : 264.3, n_buffer : 50000, eps : 3.1%
n_episode :1000, score : 226.2, n_buffer : 50000, eps : 3.0%
n_episode :1020, score : 339.1, n_buffer : 50000, eps : 2.9%
n_episode :1040, score : 369.6, n_buffer : 50000, eps : 2.8%
n_episode :1060, score : 284.8, n_buffer : 50000, eps : 2.7%
n_episode :1080, score : 371.1, n_buffer : 50000, eps : 2.6%
n_episode :1100, score : 311.1, n_buffer : 50000, eps : 2.5%
n_episode :1120, score : 333.5, n_buffer : 50000, eps : 2.4%
n_episode :1140, score : 290.6, n_buffer : 50000, eps : 2.3%
n_episode :1160, score : 228.7, n_buffer : 50000, eps : 2.2%
n_episode :1180, score : 252.2, n_buffer : 50000, eps : 2.1%
n_episode :1200, score : 266.3, n_buffer : 50000, eps : 2.0%
n_episode :1220, score : 300.1, n_buffer : 50000, eps : 1.9%
n_episode :1240, score : 284.4, n_buffer : 50000, eps : 1.8%
n_episode :1260, score : 268.3, n_buffer : 50000, eps : 1.7%
n_episode :1280, score : 194.9, n_buffer : 50000, eps : 1.6%
n_episode :1300, score : 204.7, n_buffer : 50000, eps : 1.5%
n_episode :1320, score : 159.9, n_buffer : 50000, eps : 1.4%
n_episode :1340, score : 166.1, n_buffer : 50000, eps : 1.3%
n_episode :1360, score : 238.9, n_buffer : 50000, eps : 1.2%
n_episode :1380, score : 210.2, n_buffer : 50000, eps : 1.1%
n_episode :1400, score : 213.3, n_buffer : 50000, eps : 1.0%
n_episode :1420, score : 203.6, n_buffer : 50000, eps : 1.0%
n_episode :1440, score : 168.8, n_buffer : 50000, eps : 1.0%
n_episode :1460, score : 170.5, n_buffer : 50000, eps : 1.0%
n_episode :1480, score : 152.3, n_buffer : 50000, eps : 1.0%
n_episode :1500, score : 176.6, n_buffer : 50000, eps : 1.0%
n_episode :1520, score : 150.1, n_buffer : 50000, eps : 1.0%
n_episode :1540, score : 141.3, n_buffer : 50000, eps : 1.0%
n_episode :1560, score : 134.0, n_buffer : 50000, eps : 1.0%
n_episode :1580, score : 182.6, n_buffer : 50000, eps : 1.0%
n_episode :1600, score : 190.9, n_buffer : 50000, eps : 1.0%
n_episode :1620, score : 148.8, n_buffer : 50000, eps : 1.0%
n_episode :1640, score : 171.6, n_buffer : 50000, eps : 1.0%
n_episode :1660, score : 141.8, n_buffer : 50000, eps : 1.0%
n_episode :1680, score : 155.2, n_buffer : 50000, eps : 1.0%
n_episode :1700, score : 354.4, n_buffer : 50000, eps : 1.0%
n_episode :1720, score : 174.2, n_buffer : 50000, eps : 1.0%
n_episode :1740, score : 175.9, n_buffer : 50000, eps : 1.0%
n_episode :1760, score : 389.8, n_buffer : 50000, eps : 1.0%
n_episode :1780, score : 337.1, n_buffer : 50000, eps : 1.0%
n_episode :1800, score : 252.6, n_buffer : 50000, eps : 1.0%
n_episode :1820, score : 249.8, n_buffer : 50000, eps : 1.0%
n_episode :1840, score : 377.7, n_buffer : 50000, eps : 1.0%
```

```
n_episode :1860, score : 300.0, n_buffer : 50000, eps : 1.0%
n_episode :1880, score : 337.4, n_buffer : 50000, eps : 1.0%
n_episode :1900, score : 240.8, n_buffer : 50000, eps : 1.0%
n_episode :1920, score : 322.8, n_buffer : 50000, eps : 1.0%
n_episode :1940, score : 274.2, n_buffer : 50000, eps : 1.0%
n_episode :1960, score : 372.7, n_buffer : 50000, eps : 1.0%
n_episode :1980, score : 361.8, n_buffer : 50000, eps : 1.0%
n_episode :2000, score : 218.7, n_buffer : 50000, eps : 1.0%
n_episode :2020, score : 263.9, n_buffer : 50000, eps : 1.0%
n_episode :2040, score : 309.1, n_buffer : 50000, eps : 1.0%
n_episode :2060, score : 446.1, n_buffer : 50000, eps : 1.0%
n_episode :2080, score : 327.5, n_buffer : 50000, eps : 1.0%
n_episode :2100, score : 257.8, n_buffer : 50000, eps : 1.0%
n_episode :2120, score : 381.4, n_buffer : 50000, eps : 1.0%
n_episode :2140, score : 311.8, n_buffer : 50000, eps : 1.0%
n_episode :2160, score : 450.8, n_buffer : 50000, eps : 1.0%
n_episode :2180, score : 199.6, n_buffer : 50000, eps : 1.0%
n_episode :2200, score : 165.4, n_buffer : 50000, eps : 1.0%
n_episode :2220, score : 211.3, n_buffer : 50000, eps : 1.0%
n_episode :2240, score : 132.2, n_buffer : 50000, eps : 1.0%
n_episode :2260, score : 69.2, n_buffer : 50000, eps : 1.0%
n_episode :2280, score : 140.8, n_buffer : 50000, eps : 1.0%
n_episode :2300, score : 236.2, n_buffer : 50000, eps : 1.0%
n_episode :2320, score : 263.4, n_buffer : 50000, eps : 1.0%
n_episode :2340, score : 348.7, n_buffer : 50000, eps : 1.0%
n_episode :2360, score : 194.9, n_buffer : 50000, eps : 1.0%
n_episode :2380, score : 248.9, n_buffer : 50000, eps : 1.0%
n_episode :2400, score : 284.8, n_buffer : 50000, eps : 1.0%
n_episode :2420, score : 270.2, n_buffer : 50000, eps : 1.0%
n_episode :2440, score : 200.3, n_buffer : 50000, eps : 1.0%
n_episode :2460, score : 321.7, n_buffer : 50000, eps : 1.0%
n_episode :2480, score : 282.2, n_buffer : 50000, eps : 1.0%
n_episode :2500, score : 292.9, n_buffer : 50000, eps : 1.0%
n_episode :2520, score : 457.4, n_buffer : 50000, eps : 1.0%
n_episode :2540, score : 405.6, n_buffer : 50000, eps : 1.0%
n_episode :2560, score : 361.0, n_buffer : 50000, eps : 1.0%
n_episode :2580, score : 424.4, n_buffer : 50000, eps : 1.0%
n_episode :2600, score : 393.6, n_buffer : 50000, eps : 1.0%
n_episode :2620, score : 310.6, n_buffer : 50000, eps : 1.0%
n_episode :2640, score : 326.1, n_buffer : 50000, eps : 1.0%
n_episode :2660, score : 317.6, n_buffer : 50000, eps : 1.0%
n_episode :2680, score : 340.6, n_buffer : 50000, eps : 1.0%
n_episode :2700, score : 330.6, n_buffer : 50000, eps : 1.0%
n_episode :2720, score : 340.1, n_buffer : 50000, eps : 1.0%
n_episode :2740, score : 270.0, n_buffer : 50000, eps : 1.0%
n_episode :2760, score : 291.8, n_buffer : 50000, eps : 1.0%
n_episode :2780, score : 431.1, n_buffer : 50000, eps : 1.0%
n_episode :2800, score : 428.8, n_buffer : 50000, eps : 1.0%
```

```
n_episode :2820, score : 391.6, n_buffer : 50000, eps : 1.0%
n_episode :2840, score : 316.7, n_buffer : 50000, eps : 1.0%
n_episode :2860, score : 327.7, n_buffer : 50000, eps : 1.0%
n_episode :2880, score : 376.2, n_buffer : 50000, eps : 1.0%
n_episode :2900, score : 306.5, n_buffer : 50000, eps : 1.0%
n_episode :2920, score : 383.2, n_buffer : 50000, eps : 1.0%
n_episode :2940, score : 305.4, n_buffer : 50000, eps : 1.0%
n_episode :2960, score : 338.0, n_buffer : 50000, eps : 1.0%
n_episode :2980, score : 270.8, n_buffer : 50000, eps : 1.0%
n_episode :3000, score : 230.5, n_buffer : 50000, eps : 1.0%
n_episode :3020, score : 220.9, n_buffer : 50000, eps : 1.0%
n_episode :3040, score : 277.9, n_buffer : 50000, eps : 1.0%
n_episode :3060, score : 237.1, n_buffer : 50000, eps : 1.0%
n_episode :3080, score : 250.4, n_buffer : 50000, eps : 1.0%
n_episode :3100, score : 201.5, n_buffer : 50000, eps : 1.0%
n_episode :3120, score : 371.9, n_buffer : 50000, eps : 1.0%
n_episode :3140, score : 289.8, n_buffer : 50000, eps : 1.0%
n_episode :3160, score : 184.9, n_buffer : 50000, eps : 1.0%
n_episode :3180, score : 204.7, n_buffer : 50000, eps : 1.0%
n_episode :3200, score : 171.2, n_buffer : 50000, eps : 1.0%
n_episode :3220, score : 163.7, n_buffer : 50000, eps : 1.0%
n_episode :3240, score : 194.5, n_buffer : 50000, eps : 1.0%
n_episode :3260, score : 199.0, n_buffer : 50000, eps : 1.0%
n_episode :3280, score : 171.4, n_buffer : 50000, eps : 1.0%
n_episode :3300, score : 198.8, n_buffer : 50000, eps : 1.0%
n_episode :3320, score : 151.1, n_buffer : 50000, eps : 1.0%
n_episode :3340, score : 152.7, n_buffer : 50000, eps : 1.0%
n_episode :3360, score : 150.2, n_buffer : 50000, eps : 1.0%
n_episode :3380, score : 247.8, n_buffer : 50000, eps : 1.0%
n_episode :3400, score : 193.8, n_buffer : 50000, eps : 1.0%
n_episode :3420, score : 206.7, n_buffer : 50000, eps : 1.0%
n_episode :3440, score : 323.0, n_buffer : 50000, eps : 1.0%
n_episode :3460, score : 227.6, n_buffer : 50000, eps : 1.0%
n_episode :3480, score : 317.9, n_buffer : 50000, eps : 1.0%
n_episode :3500, score : 230.4, n_buffer : 50000, eps : 1.0%
n_episode :3520, score : 247.3, n_buffer : 50000, eps : 1.0%
n_episode :3540, score : 221.2, n_buffer : 50000, eps : 1.0%
n_episode :3560, score : 239.6, n_buffer : 50000, eps : 1.0%
n_episode :3580, score : 407.6, n_buffer : 50000, eps : 1.0%
n_episode :3600, score : 444.4, n_buffer : 50000, eps : 1.0%
n_episode :3620, score : 462.9, n_buffer : 50000, eps : 1.0%
n_episode :3640, score : 388.4, n_buffer : 50000, eps : 1.0%
n_episode :3660, score : 425.8, n_buffer : 50000, eps : 1.0%
n_episode :3680, score : 334.1, n_buffer : 50000, eps : 1.0%
n_episode :3700, score : 300.5, n_buffer : 50000, eps : 1.0%
n_episode :3720, score : 460.6, n_buffer : 50000, eps : 1.0%
n_episode :3740, score : 359.4, n_buffer : 50000, eps : 1.0%
n_episode :3760, score : 467.8, n_buffer : 50000, eps : 1.0%
```

```
n_episode :3780, score : 333.6, n_buffer : 50000, eps : 1.0%
n_episode :3800, score : 395.9, n_buffer : 50000, eps : 1.0%
n_episode :3820, score : 444.1, n_buffer : 50000, eps : 1.0%
n_episode :3840, score : 486.2, n_buffer : 50000, eps : 1.0%
n_episode :3860, score : 440.7, n_buffer : 50000, eps : 1.0%
n_episode :3880, score : 322.2, n_buffer : 50000, eps : 1.0%
n_episode :3900, score : 412.7, n_buffer : 50000, eps : 1.0%
n_episode :3920, score : 467.9, n_buffer : 50000, eps : 1.0%
n_episode :3940, score : 356.8, n_buffer : 50000, eps : 1.0%
n_episode :3960, score : 447.0, n_buffer : 50000, eps : 1.0%
n_episode :3980, score : 404.8, n_buffer : 50000, eps : 1.0%
n_episode :4000, score : 387.2, n_buffer : 50000, eps : 1.0%
n_episode :4020, score : 438.1, n_buffer : 50000, eps : 1.0%
n_episode :4040, score : 399.1, n_buffer : 50000, eps : 1.0%
n_episode :4060, score : 443.3, n_buffer : 50000, eps : 1.0%
n_episode :4080, score : 424.1, n_buffer : 50000, eps : 1.0%
n_episode :4100, score : 402.1, n_buffer : 50000, eps : 1.0%
n_episode :4120, score : 305.1, n_buffer : 50000, eps : 1.0%
n_episode :4140, score : 278.2, n_buffer : 50000, eps : 1.0%
n_episode :4160, score : 267.9, n_buffer : 50000, eps : 1.0%
n_episode :4180, score : 241.6, n_buffer : 50000, eps : 1.0%
n_episode :4200, score : 218.2, n_buffer : 50000, eps : 1.0%
n_episode :4220, score : 278.1, n_buffer : 50000, eps : 1.0%
n_episode :4240, score : 219.1, n_buffer : 50000, eps : 1.0%
n_episode :4260, score : 226.8, n_buffer : 50000, eps : 1.0%
n_episode :4280, score : 210.1, n_buffer : 50000, eps : 1.0%
n_episode :4300, score : 249.7, n_buffer : 50000, eps : 1.0%
n_episode :4320, score : 191.2, n_buffer : 50000, eps : 1.0%
n_episode :4340, score : 220.8, n_buffer : 50000, eps : 1.0%
n_episode :4360, score : 170.6, n_buffer : 50000, eps : 1.0%
n_episode :4380, score : 202.4, n_buffer : 50000, eps : 1.0%
n_episode :4400, score : 216.2, n_buffer : 50000, eps : 1.0%
n_episode :4420, score : 157.6, n_buffer : 50000, eps : 1.0%
n_episode :4440, score : 252.1, n_buffer : 50000, eps : 1.0%
n_episode :4460, score : 227.2, n_buffer : 50000, eps : 1.0%
n_episode :4480, score : 210.9, n_buffer : 50000, eps : 1.0%
n_episode :4500, score : 240.7, n_buffer : 50000, eps : 1.0%
n_episode :4520, score : 240.7, n_buffer : 50000, eps : 1.0%
n_episode :4540, score : 87.7, n_buffer : 50000, eps : 1.0%
n_episode :4560, score : 169.9, n_buffer : 50000, eps : 1.0%
n_episode :4580, score : 201.0, n_buffer : 50000, eps : 1.0%
n_episode :4600, score : 222.3, n_buffer : 50000, eps : 1.0%
n_episode :4620, score : 286.8, n_buffer : 50000, eps : 1.0%
n_episode :4640, score : 283.1, n_buffer : 50000, eps : 1.0%
n_episode :4660, score : 290.9, n_buffer : 50000, eps : 1.0%
n_episode :4680, score : 323.8, n_buffer : 50000, eps : 1.0%
n_episode :4700, score : 348.8, n_buffer : 50000, eps : 1.0%
n_episode :4720, score : 458.4, n_buffer : 50000, eps : 1.0%
```

```
n_episode :4740, score : 356.4, n_buffer : 50000, eps : 1.0%
n_episode :4760, score : 386.8, n_buffer : 50000, eps : 1.0%
n_episode :4780, score : 291.9, n_buffer : 50000, eps : 1.0%
n_episode :4800, score : 304.6, n_buffer : 50000, eps : 1.0%
n_episode :4820, score : 340.8, n_buffer : 50000, eps : 1.0%
n_episode :4840, score : 481.9, n_buffer : 50000, eps : 1.0%
n_episode :4860, score : 351.7, n_buffer : 50000, eps : 1.0%
n_episode :4880, score : 411.8, n_buffer : 50000, eps : 1.0%
n_episode :4900, score : 454.6, n_buffer : 50000, eps : 1.0%
n_episode :4920, score : 432.0, n_buffer : 50000, eps : 1.0%
n_episode :4940, score : 353.6, n_buffer : 50000, eps : 1.0%
n_episode :4960, score : 390.1, n_buffer : 50000, eps : 1.0%
n_episode :4980, score : 355.6, n_buffer : 50000, eps : 1.0%
n_episode :5000, score : 408.8, n_buffer : 50000, eps : 1.0%
n_episode :5020, score : 305.1, n_buffer : 50000, eps : 1.0%
n_episode :5040, score : 223.8, n_buffer : 50000, eps : 1.0%
n_episode :5060, score : 209.8, n_buffer : 50000, eps : 1.0%
n_episode :5080, score : 291.1, n_buffer : 50000, eps : 1.0%
n_episode :5100, score : 279.8, n_buffer : 50000, eps : 1.0%
n_episode :5120, score : 355.1, n_buffer : 50000, eps : 1.0%
n_episode :5140, score : 470.6, n_buffer : 50000, eps : 1.0%
n_episode :5160, score : 479.1, n_buffer : 50000, eps : 1.0%
n_episode :5180, score : 233.7, n_buffer : 50000, eps : 1.0%
n_episode :5200, score : 212.3, n_buffer : 50000, eps : 1.0%
n_episode :5220, score : 181.4, n_buffer : 50000, eps : 1.0%
n_episode :5240, score : 206.1, n_buffer : 50000, eps : 1.0%
n_episode :5260, score : 272.2, n_buffer : 50000, eps : 1.0%
n_episode :5280, score : 304.1, n_buffer : 50000, eps : 1.0%
n_episode :5300, score : 386.9, n_buffer : 50000, eps : 1.0%
n_episode :5320, score : 345.3, n_buffer : 50000, eps : 1.0%
n_episode :5340, score : 264.1, n_buffer : 50000, eps : 1.0%
n_episode :5360, score : 235.3, n_buffer : 50000, eps : 1.0%
n_episode :5380, score : 293.6, n_buffer : 50000, eps : 1.0%
n_episode :5400, score : 256.9, n_buffer : 50000, eps : 1.0%
n_episode :5420, score : 315.1, n_buffer : 50000, eps : 1.0%
n_episode :5440, score : 380.4, n_buffer : 50000, eps : 1.0%
n_episode :5460, score : 338.9, n_buffer : 50000, eps : 1.0%
n_episode :5480, score : 334.5, n_buffer : 50000, eps : 1.0%
n_episode :5500, score : 373.4, n_buffer : 50000, eps : 1.0%
n_episode :5520, score : 278.6, n_buffer : 50000, eps : 1.0%
n_episode :5540, score : 265.4, n_buffer : 50000, eps : 1.0%
n_episode :5560, score : 265.4, n_buffer : 50000, eps : 1.0%
n_episode :5580, score : 348.3, n_buffer : 50000, eps : 1.0%
n_episode :5600, score : 447.7, n_buffer : 50000, eps : 1.0%
n_episode :5620, score : 481.3, n_buffer : 50000, eps : 1.0%
n_episode :5640, score : 449.5, n_buffer : 50000, eps : 1.0%
n_episode :5660, score : 441.6, n_buffer : 50000, eps : 1.0%
n_episode :5680, score : 329.4, n_buffer : 50000, eps : 1.0%
```

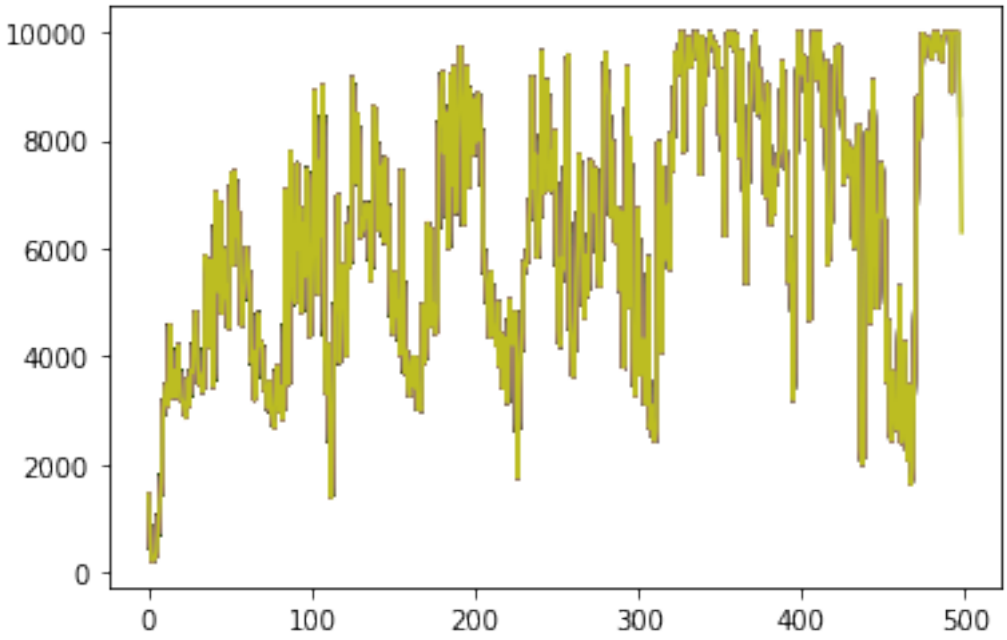
```
n_episode :5700, score : 398.8, n_buffer : 50000, eps : 1.0%
n_episode :5720, score : 336.8, n_buffer : 50000, eps : 1.0%
n_episode :5740, score : 305.7, n_buffer : 50000, eps : 1.0%
n_episode :5760, score : 337.5, n_buffer : 50000, eps : 1.0%
n_episode :5780, score : 335.8, n_buffer : 50000, eps : 1.0%
n_episode :5800, score : 261.5, n_buffer : 50000, eps : 1.0%
n_episode :5820, score : 332.6, n_buffer : 50000, eps : 1.0%
n_episode :5840, score : 190.1, n_buffer : 50000, eps : 1.0%
n_episode :5860, score : 273.6, n_buffer : 50000, eps : 1.0%
n_episode :5880, score : 467.8, n_buffer : 50000, eps : 1.0%
n_episode :5900, score : 245.3, n_buffer : 50000, eps : 1.0%
n_episode :5920, score : 402.4, n_buffer : 50000, eps : 1.0%
n_episode :5940, score : 308.6, n_buffer : 50000, eps : 1.0%
n_episode :5960, score : 195.5, n_buffer : 50000, eps : 1.0%
n_episode :5980, score : 163.6, n_buffer : 50000, eps : 1.0%
n_episode :6000, score : 208.8, n_buffer : 50000, eps : 1.0%
n_episode :6020, score : 337.1, n_buffer : 50000, eps : 1.0%
n_episode :6040, score : 183.0, n_buffer : 50000, eps : 1.0%
n_episode :6060, score : 213.8, n_buffer : 50000, eps : 1.0%
n_episode :6080, score : 215.4, n_buffer : 50000, eps : 1.0%
n_episode :6100, score : 156.2, n_buffer : 50000, eps : 1.0%
n_episode :6120, score : 156.2, n_buffer : 50000, eps : 1.0%
n_episode :6140, score : 291.2, n_buffer : 50000, eps : 1.0%
n_episode :6160, score : 133.8, n_buffer : 50000, eps : 1.0%
n_episode :6180, score : 154.5, n_buffer : 50000, eps : 1.0%
n_episode :6200, score : 126.2, n_buffer : 50000, eps : 1.0%
n_episode :6220, score : 121.7, n_buffer : 50000, eps : 1.0%
n_episode :6240, score : 130.8, n_buffer : 50000, eps : 1.0%
n_episode :6260, score : 397.1, n_buffer : 50000, eps : 1.0%
n_episode :6280, score : 397.4, n_buffer : 50000, eps : 1.0%
n_episode :6300, score : 203.6, n_buffer : 50000, eps : 1.0%
n_episode :6320, score : 375.1, n_buffer : 50000, eps : 1.0%
n_episode :6340, score : 290.6, n_buffer : 50000, eps : 1.0%
n_episode :6360, score : 290.2, n_buffer : 50000, eps : 1.0%
n_episode :6380, score : 339.6, n_buffer : 50000, eps : 1.0%
n_episode :6400, score : 280.9, n_buffer : 50000, eps : 1.0%
n_episode :6420, score : 405.9, n_buffer : 50000, eps : 1.0%
n_episode :6440, score : 372.4, n_buffer : 50000, eps : 1.0%
n_episode :6460, score : 439.9, n_buffer : 50000, eps : 1.0%
n_episode :6480, score : 481.6, n_buffer : 50000, eps : 1.0%
n_episode :6500, score : 461.2, n_buffer : 50000, eps : 1.0%
n_episode :6520, score : 475.8, n_buffer : 50000, eps : 1.0%
n_episode :6540, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :6560, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :6580, score : 389.7, n_buffer : 50000, eps : 1.0%
n_episode :6600, score : 462.8, n_buffer : 50000, eps : 1.0%
n_episode :6620, score : 473.6, n_buffer : 50000, eps : 1.0%
n_episode :6640, score : 495.4, n_buffer : 50000, eps : 1.0%
```

```
n_episode :6660, score : 467.8, n_buffer : 50000, eps : 1.0%
n_episode :6680, score : 476.4, n_buffer : 50000, eps : 1.0%
n_episode :6700, score : 477.0, n_buffer : 50000, eps : 1.0%
n_episode :6720, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :6740, score : 496.3, n_buffer : 50000, eps : 1.0%
n_episode :6760, score : 483.7, n_buffer : 50000, eps : 1.0%
n_episode :6780, score : 368.9, n_buffer : 50000, eps : 1.0%
n_episode :6800, score : 496.2, n_buffer : 50000, eps : 1.0%
n_episode :6820, score : 433.8, n_buffer : 50000, eps : 1.0%
n_episode :6840, score : 459.8, n_buffer : 50000, eps : 1.0%
n_episode :6860, score : 472.1, n_buffer : 50000, eps : 1.0%
n_episode :6880, score : 487.4, n_buffer : 50000, eps : 1.0%
n_episode :6900, score : 499.3, n_buffer : 50000, eps : 1.0%
n_episode :6920, score : 490.5, n_buffer : 50000, eps : 1.0%
n_episode :6940, score : 487.6, n_buffer : 50000, eps : 1.0%
n_episode :6960, score : 490.6, n_buffer : 50000, eps : 1.0%
n_episode :6980, score : 469.1, n_buffer : 50000, eps : 1.0%
n_episode :7000, score : 485.4, n_buffer : 50000, eps : 1.0%
n_episode :7020, score : 406.7, n_buffer : 50000, eps : 1.0%
n_episode :7040, score : 464.7, n_buffer : 50000, eps : 1.0%
n_episode :7060, score : 358.8, n_buffer : 50000, eps : 1.0%
n_episode :7080, score : 311.8, n_buffer : 50000, eps : 1.0%
n_episode :7100, score : 487.8, n_buffer : 50000, eps : 1.0%
n_episode :7120, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :7140, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :7160, score : 489.3, n_buffer : 50000, eps : 1.0%
n_episode :7180, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :7200, score : 484.3, n_buffer : 50000, eps : 1.0%
n_episode :7220, score : 497.8, n_buffer : 50000, eps : 1.0%
n_episode :7240, score : 452.1, n_buffer : 50000, eps : 1.0%
n_episode :7260, score : 384.7, n_buffer : 50000, eps : 1.0%
n_episode :7280, score : 483.1, n_buffer : 50000, eps : 1.0%
n_episode :7300, score : 409.1, n_buffer : 50000, eps : 1.0%
n_episode :7320, score : 329.4, n_buffer : 50000, eps : 1.0%
n_episode :7340, score : 268.0, n_buffer : 50000, eps : 1.0%
n_episode :7360, score : 335.4, n_buffer : 50000, eps : 1.0%
n_episode :7380, score : 431.0, n_buffer : 50000, eps : 1.0%
n_episode :7400, score : 444.5, n_buffer : 50000, eps : 1.0%
n_episode :7420, score : 482.4, n_buffer : 50000, eps : 1.0%
n_episode :7440, score : 494.2, n_buffer : 50000, eps : 1.0%
n_episode :7460, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :7480, score : 425.3, n_buffer : 50000, eps : 1.0%
n_episode :7500, score : 465.4, n_buffer : 50000, eps : 1.0%
n_episode :7520, score : 434.7, n_buffer : 50000, eps : 1.0%
n_episode :7540, score : 434.6, n_buffer : 50000, eps : 1.0%
n_episode :7560, score : 377.0, n_buffer : 50000, eps : 1.0%
n_episode :7580, score : 347.4, n_buffer : 50000, eps : 1.0%
n_episode :7600, score : 452.0, n_buffer : 50000, eps : 1.0%
```

```
n_episode :7620, score : 435.2, n_buffer : 50000, eps : 1.0%
n_episode :7640, score : 322.6, n_buffer : 50000, eps : 1.0%
n_episode :7660, score : 374.4, n_buffer : 50000, eps : 1.0%
n_episode :7680, score : 332.1, n_buffer : 50000, eps : 1.0%
n_episode :7700, score : 372.4, n_buffer : 50000, eps : 1.0%
n_episode :7720, score : 371.4, n_buffer : 50000, eps : 1.0%
n_episode :7740, score : 387.4, n_buffer : 50000, eps : 1.0%
n_episode :7760, score : 389.9, n_buffer : 50000, eps : 1.0%
n_episode :7780, score : 472.8, n_buffer : 50000, eps : 1.0%
n_episode :7800, score : 459.2, n_buffer : 50000, eps : 1.0%
n_episode :7820, score : 393.9, n_buffer : 50000, eps : 1.0%
n_episode :7840, score : 371.8, n_buffer : 50000, eps : 1.0%
n_episode :7860, score : 269.4, n_buffer : 50000, eps : 1.0%
n_episode :7880, score : 308.6, n_buffer : 50000, eps : 1.0%
n_episode :7900, score : 269.1, n_buffer : 50000, eps : 1.0%
n_episode :7920, score : 159.9, n_buffer : 50000, eps : 1.0%
n_episode :7940, score : 282.1, n_buffer : 50000, eps : 1.0%
n_episode :7960, score : 429.9, n_buffer : 50000, eps : 1.0%
n_episode :7980, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :8000, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :8020, score : 461.1, n_buffer : 50000, eps : 1.0%
n_episode :8040, score : 477.8, n_buffer : 50000, eps : 1.0%
n_episode :8060, score : 475.6, n_buffer : 50000, eps : 1.0%
n_episode :8080, score : 402.6, n_buffer : 50000, eps : 1.0%
n_episode :8100, score : 451.4, n_buffer : 50000, eps : 1.0%
n_episode :8120, score : 233.9, n_buffer : 50000, eps : 1.0%
n_episode :8140, score : 480.4, n_buffer : 50000, eps : 1.0%
n_episode :8160, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :8180, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :8200, score : 456.2, n_buffer : 50000, eps : 1.0%
n_episode :8220, score : 482.6, n_buffer : 50000, eps : 1.0%
n_episode :8240, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :8260, score : 457.5, n_buffer : 50000, eps : 1.0%
n_episode :8280, score : 413.3, n_buffer : 50000, eps : 1.0%
n_episode :8300, score : 442.5, n_buffer : 50000, eps : 1.0%
n_episode :8320, score : 473.1, n_buffer : 50000, eps : 1.0%
n_episode :8340, score : 284.8, n_buffer : 50000, eps : 1.0%
n_episode :8360, score : 294.8, n_buffer : 50000, eps : 1.0%
n_episode :8380, score : 323.7, n_buffer : 50000, eps : 1.0%
n_episode :8400, score : 364.3, n_buffer : 50000, eps : 1.0%
n_episode :8420, score : 459.6, n_buffer : 50000, eps : 1.0%
n_episode :8440, score : 484.9, n_buffer : 50000, eps : 1.0%
n_episode :8460, score : 483.6, n_buffer : 50000, eps : 1.0%
n_episode :8480, score : 486.9, n_buffer : 50000, eps : 1.0%
n_episode :8500, score : 430.1, n_buffer : 50000, eps : 1.0%
n_episode :8520, score : 437.6, n_buffer : 50000, eps : 1.0%
n_episode :8540, score : 360.4, n_buffer : 50000, eps : 1.0%
n_episode :8560, score : 388.3, n_buffer : 50000, eps : 1.0%
```

```
n_episode :8580, score : 398.6, n_buffer : 50000, eps : 1.0%
n_episode :8600, score : 369.0, n_buffer : 50000, eps : 1.0%
n_episode :8620, score : 392.8, n_buffer : 50000, eps : 1.0%
n_episode :8640, score : 355.5, n_buffer : 50000, eps : 1.0%
n_episode :8660, score : 301.4, n_buffer : 50000, eps : 1.0%
n_episode :8680, score : 390.9, n_buffer : 50000, eps : 1.0%
n_episode :8700, score : 395.4, n_buffer : 50000, eps : 1.0%
n_episode :8720, score : 413.9, n_buffer : 50000, eps : 1.0%
n_episode :8740, score : 114.0, n_buffer : 50000, eps : 1.0%
n_episode :8760, score : 100.3, n_buffer : 50000, eps : 1.0%
n_episode :8780, score : 108.0, n_buffer : 50000, eps : 1.0%
n_episode :8800, score : 312.3, n_buffer : 50000, eps : 1.0%
n_episode :8820, score : 407.4, n_buffer : 50000, eps : 1.0%
n_episode :8840, score : 404.6, n_buffer : 50000, eps : 1.0%
n_episode :8860, score : 231.2, n_buffer : 50000, eps : 1.0%
n_episode :8880, score : 414.7, n_buffer : 50000, eps : 1.0%
n_episode :8900, score : 455.1, n_buffer : 50000, eps : 1.0%
n_episode :8920, score : 290.9, n_buffer : 50000, eps : 1.0%
n_episode :8940, score : 244.8, n_buffer : 50000, eps : 1.0%
n_episode :8960, score : 331.1, n_buffer : 50000, eps : 1.0%
n_episode :8980, score : 330.2, n_buffer : 50000, eps : 1.0%
n_episode :9000, score : 378.1, n_buffer : 50000, eps : 1.0%
n_episode :9020, score : 329.0, n_buffer : 50000, eps : 1.0%
n_episode :9040, score : 326.0, n_buffer : 50000, eps : 1.0%
n_episode :9060, score : 176.9, n_buffer : 50000, eps : 1.0%
n_episode :9080, score : 232.8, n_buffer : 50000, eps : 1.0%
n_episode :9100, score : 131.2, n_buffer : 50000, eps : 1.0%
n_episode :9120, score : 122.1, n_buffer : 50000, eps : 1.0%
n_episode :9140, score : 185.9, n_buffer : 50000, eps : 1.0%
n_episode :9160, score : 150.3, n_buffer : 50000, eps : 1.0%
n_episode :9180, score : 132.8, n_buffer : 50000, eps : 1.0%
n_episode :9200, score : 132.6, n_buffer : 50000, eps : 1.0%
n_episode :9220, score : 263.9, n_buffer : 50000, eps : 1.0%
n_episode :9240, score : 120.4, n_buffer : 50000, eps : 1.0%
n_episode :9260, score : 184.0, n_buffer : 50000, eps : 1.0%
n_episode :9280, score : 213.0, n_buffer : 50000, eps : 1.0%
n_episode :9300, score : 124.3, n_buffer : 50000, eps : 1.0%
n_episode :9320, score : 103.8, n_buffer : 50000, eps : 1.0%
n_episode :9340, score : 173.1, n_buffer : 50000, eps : 1.0%
n_episode :9360, score : 81.4, n_buffer : 50000, eps : 1.0%
n_episode :9380, score : 97.2, n_buffer : 50000, eps : 1.0%
n_episode :9400, score : 189.8, n_buffer : 50000, eps : 1.0%
n_episode :9420, score : 287.2, n_buffer : 50000, eps : 1.0%
n_episode :9440, score : 440.1, n_buffer : 50000, eps : 1.0%
n_episode :9460, score : 401.6, n_buffer : 50000, eps : 1.0%
n_episode :9480, score : 422.2, n_buffer : 50000, eps : 1.0%
n_episode :9500, score : 498.8, n_buffer : 50000, eps : 1.0%
n_episode :9520, score : 477.9, n_buffer : 50000, eps : 1.0%
```

```
n_episode :9540, score : 494.8, n_buffer : 50000, eps : 1.0%
n_episode :9560, score : 494.6, n_buffer : 50000, eps : 1.0%
n_episode :9580, score : 493.8, n_buffer : 50000, eps : 1.0%
n_episode :9600, score : 477.3, n_buffer : 50000, eps : 1.0%
n_episode :9620, score : 475.8, n_buffer : 50000, eps : 1.0%
n_episode :9640, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :9660, score : 483.1, n_buffer : 50000, eps : 1.0%
n_episode :9680, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :9700, score : 495.3, n_buffer : 50000, eps : 1.0%
n_episode :9720, score : 475.4, n_buffer : 50000, eps : 1.0%
n_episode :9740, score : 473.6, n_buffer : 50000, eps : 1.0%
n_episode :9760, score : 494.4, n_buffer : 50000, eps : 1.0%
n_episode :9780, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :9800, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :9820, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :9840, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :9860, score : 444.8, n_buffer : 50000, eps : 1.0%
n_episode :9880, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :9900, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :9920, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :9940, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :9960, score : 423.6, n_buffer : 50000, eps : 1.0%
n_episode :9980, score : 315.0, n_buffer : 50000, eps : 1.0%
```



[ ]:
```
#NEW EPSILON VALUE to fixed values  {0.01,0.1}  and plot its impact on learning.
↪
```

```
#Hyperparameters
learning_rate = 0.0005
gamma         = 0.98
buffer_limit  = 50000
batch_size    = 32

class ReplayBuffer():
    def __init__(self):
        self.buffer = collections.deque(maxlen=buffer_limit)

    def put(self, transition):
        self.buffer.append(transition)

    def sample(self, n):
        mini_batch = random.sample(self.buffer, n)
        s_lst, a_lst, r_lst, s_prime_lst, done_mask_lst = [], [], [], [], []

        for transition in mini_batch:
            s, a, r, s_prime, done_mask = transition
            s_lst.append(s)
            a_lst.append([a])
            r_lst.append([r])
            s_prime_lst.append(s_prime)
            done_mask_lst.append([done_mask])

        return torch.tensor(s_lst, dtype=torch.float), torch.tensor(a_lst), \
               torch.tensor(r_lst), torch.tensor(s_prime_lst, dtype=torch.
 ↪float), \
               torch.tensor(done_mask_lst)

    def size(self):
        return len(self.buffer)

class Qnet(nn.Module):
    def __init__(self):
        super(Qnet, self).__init__()
        self.fc1 = nn.Linear(4, 128)
        self.fc2 = nn.Linear(128, 128)
        self.fc3 = nn.Linear(128, 2)

    def forward(self, x):
        x = F.relu(self.fc1(x))
        x = F.relu(self.fc2(x))
        x = self.fc3(x)
        return x
```

```
    def sample_action(self, obs, epsilon):
        out = self.forward(obs)
        coin = random.random()
        if coin < epsilon:
            return random.randint(0,1)
        else :
            return out.argmax().item()

def train(q, q_target, memory, optimizer):
    for i in range(10):
        s,a,r,s_prime,done_mask = memory.sample(batch_size)

        q_out = q(s)
        q_a = q_out.gather(1,a)
        max_q_prime = q_target(s_prime).max(1)[0].unsqueeze(1)
        target = r + gamma * max_q_prime * done_mask
        loss = F.smooth_l1_loss(q_a, target)

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


def main():
    env = gym.make('CartPole-v1')
    q = Qnet()
    q_target = Qnet()
    q_target.load_state_dict(q.state_dict())
    memory = ReplayBuffer()

    print_interval = 20
    score = 0.0
    optimizer = optim.Adam(q.parameters(), lr=learning_rate)
    total_score = []
    list_epsilon = []

    for n_epi in range(10000):
        epsilon = max(0.01, 0.1 - 0.01*(n_epi/200)) #Linear annealing from {0.
↪01,0.1}
        s = env.reset()
        done = False

        while not done:
            a = q.sample_action(torch.from_numpy(s).float(), epsilon)
            s_prime, r, done, info = env.step(a)
            done_mask = 0.0 if done else 1.0
            memory.put((s,a,r/100.0,s_prime, done_mask))
```

```
            s = s_prime

            score += r
            if done:
                break

        if memory.size()>2000:
            train(q, q_target, memory, optimizer)

        if n_epi%print_interval==0 and n_epi!=0:
            q_target.load_state_dict(q.state_dict())
            print("n_episode :{}, score : {:.1f}, n_buffer : {}, eps : {:.1f}%".
 ↪format(
                                                        n_epi, score/
 ↪print_interval, memory.size(), epsilon*100))

            total_score.append(score)
            list_epsilon.append(epsilon)
            plt.plot(total_score)

            score = 0.0
    env.close()

if __name__ == '__main__':
    main()
    plt.show()
```

```
n_episode :20, score : 10.4, n_buffer : 209, eps : 9.9%
n_episode :40, score : 10.1, n_buffer : 410, eps : 9.8%
n_episode :60, score : 10.0, n_buffer : 610, eps : 9.7%
n_episode :80, score : 9.6, n_buffer : 802, eps : 9.6%
n_episode :100, score : 9.8, n_buffer : 997, eps : 9.5%
n_episode :120, score : 9.6, n_buffer : 1189, eps : 9.4%
n_episode :140, score : 9.8, n_buffer : 1386, eps : 9.3%
n_episode :160, score : 9.8, n_buffer : 1582, eps : 9.2%
n_episode :180, score : 9.2, n_buffer : 1766, eps : 9.1%
n_episode :200, score : 9.8, n_buffer : 1963, eps : 9.0%
n_episode :220, score : 28.6, n_buffer : 2535, eps : 8.9%
n_episode :240, score : 38.5, n_buffer : 3305, eps : 8.8%
n_episode :260, score : 66.2, n_buffer : 4630, eps : 8.7%
n_episode :280, score : 50.0, n_buffer : 5630, eps : 8.6%
n_episode :300, score : 71.5, n_buffer : 7059, eps : 8.5%
n_episode :320, score : 127.5, n_buffer : 9608, eps : 8.4%
n_episode :340, score : 176.9, n_buffer : 13147, eps : 8.3%
n_episode :360, score : 208.8, n_buffer : 17323, eps : 8.2%
n_episode :380, score : 216.9, n_buffer : 21662, eps : 8.1%
n_episode :400, score : 187.2, n_buffer : 25406, eps : 8.0%
```

```
n_episode :420, score : 132.1, n_buffer : 28047, eps : 7.9%
n_episode :440, score : 169.8, n_buffer : 31443, eps : 7.8%
n_episode :460, score : 223.3, n_buffer : 35910, eps : 7.7%
n_episode :480, score : 282.4, n_buffer : 41557, eps : 7.6%
n_episode :500, score : 222.7, n_buffer : 46011, eps : 7.5%
n_episode :520, score : 181.8, n_buffer : 49646, eps : 7.4%
n_episode :540, score : 205.4, n_buffer : 50000, eps : 7.3%
n_episode :560, score : 189.8, n_buffer : 50000, eps : 7.2%
n_episode :580, score : 223.9, n_buffer : 50000, eps : 7.1%
n_episode :600, score : 250.3, n_buffer : 50000, eps : 7.0%
n_episode :620, score : 246.8, n_buffer : 50000, eps : 6.9%
n_episode :640, score : 272.8, n_buffer : 50000, eps : 6.8%
n_episode :660, score : 276.9, n_buffer : 50000, eps : 6.7%
n_episode :680, score : 192.3, n_buffer : 50000, eps : 6.6%
n_episode :700, score : 206.5, n_buffer : 50000, eps : 6.5%
n_episode :720, score : 259.8, n_buffer : 50000, eps : 6.4%
n_episode :740, score : 289.6, n_buffer : 50000, eps : 6.3%
n_episode :760, score : 385.1, n_buffer : 50000, eps : 6.2%
n_episode :780, score : 245.2, n_buffer : 50000, eps : 6.1%
n_episode :800, score : 247.3, n_buffer : 50000, eps : 6.0%
n_episode :820, score : 320.5, n_buffer : 50000, eps : 5.9%
n_episode :840, score : 300.4, n_buffer : 50000, eps : 5.8%
n_episode :860, score : 303.4, n_buffer : 50000, eps : 5.7%
n_episode :880, score : 254.4, n_buffer : 50000, eps : 5.6%
n_episode :900, score : 241.5, n_buffer : 50000, eps : 5.5%
n_episode :920, score : 218.2, n_buffer : 50000, eps : 5.4%
n_episode :940, score : 211.1, n_buffer : 50000, eps : 5.3%
n_episode :960, score : 162.3, n_buffer : 50000, eps : 5.2%
n_episode :980, score : 249.6, n_buffer : 50000, eps : 5.1%
n_episode :1000, score : 309.5, n_buffer : 50000, eps : 5.0%
n_episode :1020, score : 217.8, n_buffer : 50000, eps : 4.9%
n_episode :1040, score : 218.3, n_buffer : 50000, eps : 4.8%
n_episode :1060, score : 250.7, n_buffer : 50000, eps : 4.7%
n_episode :1080, score : 257.1, n_buffer : 50000, eps : 4.6%
n_episode :1100, score : 172.9, n_buffer : 50000, eps : 4.5%
n_episode :1120, score : 244.6, n_buffer : 50000, eps : 4.4%
n_episode :1140, score : 171.5, n_buffer : 50000, eps : 4.3%
n_episode :1160, score : 104.4, n_buffer : 50000, eps : 4.2%
n_episode :1180, score : 202.2, n_buffer : 50000, eps : 4.1%
n_episode :1200, score : 177.6, n_buffer : 50000, eps : 4.0%
n_episode :1220, score : 216.4, n_buffer : 50000, eps : 3.9%
n_episode :1240, score : 221.9, n_buffer : 50000, eps : 3.8%
n_episode :1260, score : 202.7, n_buffer : 50000, eps : 3.7%
n_episode :1280, score : 252.3, n_buffer : 50000, eps : 3.6%
n_episode :1300, score : 289.8, n_buffer : 50000, eps : 3.5%
n_episode :1320, score : 300.5, n_buffer : 50000, eps : 3.4%
n_episode :1340, score : 134.3, n_buffer : 50000, eps : 3.3%
n_episode :1360, score : 260.4, n_buffer : 50000, eps : 3.2%
```

```
n_episode :1380, score : 145.3, n_buffer : 50000, eps : 3.1%
n_episode :1400, score : 247.2, n_buffer : 50000, eps : 3.0%
n_episode :1420, score : 337.1, n_buffer : 50000, eps : 2.9%
n_episode :1440, score : 244.6, n_buffer : 50000, eps : 2.8%
n_episode :1460, score : 281.6, n_buffer : 50000, eps : 2.7%
n_episode :1480, score : 342.4, n_buffer : 50000, eps : 2.6%
n_episode :1500, score : 258.1, n_buffer : 50000, eps : 2.5%
n_episode :1520, score : 139.8, n_buffer : 50000, eps : 2.4%
n_episode :1540, score : 158.5, n_buffer : 50000, eps : 2.3%
n_episode :1560, score : 211.1, n_buffer : 50000, eps : 2.2%
n_episode :1580, score : 357.8, n_buffer : 50000, eps : 2.1%
n_episode :1600, score : 300.3, n_buffer : 50000, eps : 2.0%
n_episode :1620, score : 386.8, n_buffer : 50000, eps : 1.9%
n_episode :1640, score : 282.6, n_buffer : 50000, eps : 1.8%
n_episode :1660, score : 364.2, n_buffer : 50000, eps : 1.7%
n_episode :1680, score : 304.4, n_buffer : 50000, eps : 1.6%
n_episode :1700, score : 314.2, n_buffer : 50000, eps : 1.5%
n_episode :1720, score : 240.1, n_buffer : 50000, eps : 1.4%
n_episode :1740, score : 252.6, n_buffer : 50000, eps : 1.3%
n_episode :1760, score : 168.9, n_buffer : 50000, eps : 1.2%
n_episode :1780, score : 277.1, n_buffer : 50000, eps : 1.1%
n_episode :1800, score : 274.4, n_buffer : 50000, eps : 1.0%
n_episode :1820, score : 301.1, n_buffer : 50000, eps : 1.0%
n_episode :1840, score : 337.6, n_buffer : 50000, eps : 1.0%
n_episode :1860, score : 405.2, n_buffer : 50000, eps : 1.0%
n_episode :1880, score : 293.9, n_buffer : 50000, eps : 1.0%
n_episode :1900, score : 390.2, n_buffer : 50000, eps : 1.0%
n_episode :1920, score : 348.8, n_buffer : 50000, eps : 1.0%
n_episode :1940, score : 317.9, n_buffer : 50000, eps : 1.0%
n_episode :1960, score : 457.1, n_buffer : 50000, eps : 1.0%
n_episode :1980, score : 371.9, n_buffer : 50000, eps : 1.0%
n_episode :2000, score : 421.9, n_buffer : 50000, eps : 1.0%
n_episode :2020, score : 313.1, n_buffer : 50000, eps : 1.0%
n_episode :2040, score : 420.8, n_buffer : 50000, eps : 1.0%
n_episode :2060, score : 435.8, n_buffer : 50000, eps : 1.0%
n_episode :2080, score : 369.9, n_buffer : 50000, eps : 1.0%
n_episode :2100, score : 445.9, n_buffer : 50000, eps : 1.0%
n_episode :2120, score : 371.4, n_buffer : 50000, eps : 1.0%
n_episode :2140, score : 326.5, n_buffer : 50000, eps : 1.0%
n_episode :2160, score : 316.1, n_buffer : 50000, eps : 1.0%
n_episode :2180, score : 275.4, n_buffer : 50000, eps : 1.0%
n_episode :2200, score : 315.9, n_buffer : 50000, eps : 1.0%
n_episode :2220, score : 271.8, n_buffer : 50000, eps : 1.0%
n_episode :2240, score : 421.2, n_buffer : 50000, eps : 1.0%
n_episode :2260, score : 431.6, n_buffer : 50000, eps : 1.0%
n_episode :2280, score : 366.3, n_buffer : 50000, eps : 1.0%
n_episode :2300, score : 331.2, n_buffer : 50000, eps : 1.0%
n_episode :2320, score : 442.6, n_buffer : 50000, eps : 1.0%
```

```
n_episode :2340, score : 371.4, n_buffer : 50000, eps : 1.0%
n_episode :2360, score : 382.6, n_buffer : 50000, eps : 1.0%
n_episode :2380, score : 297.1, n_buffer : 50000, eps : 1.0%
n_episode :2400, score : 388.2, n_buffer : 50000, eps : 1.0%
n_episode :2420, score : 430.4, n_buffer : 50000, eps : 1.0%
n_episode :2440, score : 341.2, n_buffer : 50000, eps : 1.0%
n_episode :2460, score : 368.2, n_buffer : 50000, eps : 1.0%
n_episode :2480, score : 367.1, n_buffer : 50000, eps : 1.0%
n_episode :2500, score : 363.4, n_buffer : 50000, eps : 1.0%
n_episode :2520, score : 429.1, n_buffer : 50000, eps : 1.0%
n_episode :2540, score : 312.1, n_buffer : 50000, eps : 1.0%
n_episode :2560, score : 252.6, n_buffer : 50000, eps : 1.0%
n_episode :2580, score : 278.3, n_buffer : 50000, eps : 1.0%
n_episode :2600, score : 309.1, n_buffer : 50000, eps : 1.0%
n_episode :2620, score : 165.2, n_buffer : 50000, eps : 1.0%
n_episode :2640, score : 204.3, n_buffer : 50000, eps : 1.0%
n_episode :2660, score : 299.8, n_buffer : 50000, eps : 1.0%
n_episode :2680, score : 229.2, n_buffer : 50000, eps : 1.0%
n_episode :2700, score : 237.8, n_buffer : 50000, eps : 1.0%
n_episode :2720, score : 142.5, n_buffer : 50000, eps : 1.0%
n_episode :2740, score : 184.7, n_buffer : 50000, eps : 1.0%
n_episode :2760, score : 226.5, n_buffer : 50000, eps : 1.0%
n_episode :2780, score : 230.1, n_buffer : 50000, eps : 1.0%
n_episode :2800, score : 247.7, n_buffer : 50000, eps : 1.0%
n_episode :2820, score : 324.8, n_buffer : 50000, eps : 1.0%
n_episode :2840, score : 380.4, n_buffer : 50000, eps : 1.0%
n_episode :2860, score : 194.7, n_buffer : 50000, eps : 1.0%
n_episode :2880, score : 221.8, n_buffer : 50000, eps : 1.0%
n_episode :2900, score : 307.4, n_buffer : 50000, eps : 1.0%
n_episode :2920, score : 362.4, n_buffer : 50000, eps : 1.0%
n_episode :2940, score : 350.2, n_buffer : 50000, eps : 1.0%
n_episode :2960, score : 225.1, n_buffer : 50000, eps : 1.0%
n_episode :2980, score : 278.9, n_buffer : 50000, eps : 1.0%
n_episode :3000, score : 260.3, n_buffer : 50000, eps : 1.0%
n_episode :3020, score : 330.6, n_buffer : 50000, eps : 1.0%
n_episode :3040, score : 330.1, n_buffer : 50000, eps : 1.0%
n_episode :3060, score : 268.1, n_buffer : 50000, eps : 1.0%
n_episode :3080, score : 302.1, n_buffer : 50000, eps : 1.0%
n_episode :3100, score : 208.1, n_buffer : 50000, eps : 1.0%
n_episode :3120, score : 315.4, n_buffer : 50000, eps : 1.0%
n_episode :3140, score : 269.1, n_buffer : 50000, eps : 1.0%
n_episode :3160, score : 336.9, n_buffer : 50000, eps : 1.0%
n_episode :3180, score : 308.3, n_buffer : 50000, eps : 1.0%
n_episode :3200, score : 304.3, n_buffer : 50000, eps : 1.0%
n_episode :3220, score : 273.9, n_buffer : 50000, eps : 1.0%
n_episode :3240, score : 253.7, n_buffer : 50000, eps : 1.0%
n_episode :3260, score : 387.8, n_buffer : 50000, eps : 1.0%
n_episode :3280, score : 322.3, n_buffer : 50000, eps : 1.0%
```

```
n_episode :3300, score : 393.2, n_buffer : 50000, eps : 1.0%
n_episode :3320, score : 216.3, n_buffer : 50000, eps : 1.0%
n_episode :3340, score : 388.4, n_buffer : 50000, eps : 1.0%
n_episode :3360, score : 468.2, n_buffer : 50000, eps : 1.0%
n_episode :3380, score : 345.9, n_buffer : 50000, eps : 1.0%
n_episode :3400, score : 325.1, n_buffer : 50000, eps : 1.0%
n_episode :3420, score : 265.1, n_buffer : 50000, eps : 1.0%
n_episode :3440, score : 426.6, n_buffer : 50000, eps : 1.0%
n_episode :3460, score : 445.8, n_buffer : 50000, eps : 1.0%
n_episode :3480, score : 360.1, n_buffer : 50000, eps : 1.0%
n_episode :3500, score : 377.9, n_buffer : 50000, eps : 1.0%
n_episode :3520, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :3540, score : 447.6, n_buffer : 50000, eps : 1.0%
n_episode :3560, score : 436.6, n_buffer : 50000, eps : 1.0%
n_episode :3580, score : 387.4, n_buffer : 50000, eps : 1.0%
n_episode :3600, score : 439.5, n_buffer : 50000, eps : 1.0%
n_episode :3620, score : 294.9, n_buffer : 50000, eps : 1.0%
n_episode :3640, score : 415.8, n_buffer : 50000, eps : 1.0%
n_episode :3660, score : 366.9, n_buffer : 50000, eps : 1.0%
n_episode :3680, score : 470.7, n_buffer : 50000, eps : 1.0%
n_episode :3700, score : 422.9, n_buffer : 50000, eps : 1.0%
n_episode :3720, score : 355.4, n_buffer : 50000, eps : 1.0%
n_episode :3740, score : 281.1, n_buffer : 50000, eps : 1.0%
n_episode :3760, score : 225.1, n_buffer : 50000, eps : 1.0%
n_episode :3780, score : 385.9, n_buffer : 50000, eps : 1.0%
n_episode :3800, score : 430.6, n_buffer : 50000, eps : 1.0%
n_episode :3820, score : 432.7, n_buffer : 50000, eps : 1.0%
n_episode :3840, score : 368.6, n_buffer : 50000, eps : 1.0%
n_episode :3860, score : 236.1, n_buffer : 50000, eps : 1.0%
n_episode :3880, score : 393.4, n_buffer : 50000, eps : 1.0%
n_episode :3900, score : 407.9, n_buffer : 50000, eps : 1.0%
n_episode :3920, score : 311.1, n_buffer : 50000, eps : 1.0%
n_episode :3940, score : 395.1, n_buffer : 50000, eps : 1.0%
n_episode :3960, score : 442.1, n_buffer : 50000, eps : 1.0%
n_episode :3980, score : 449.6, n_buffer : 50000, eps : 1.0%
n_episode :4000, score : 453.4, n_buffer : 50000, eps : 1.0%
n_episode :4020, score : 469.9, n_buffer : 50000, eps : 1.0%
n_episode :4040, score : 386.4, n_buffer : 50000, eps : 1.0%
n_episode :4060, score : 459.3, n_buffer : 50000, eps : 1.0%
n_episode :4080, score : 458.0, n_buffer : 50000, eps : 1.0%
n_episode :4100, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :4120, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :4140, score : 469.1, n_buffer : 50000, eps : 1.0%
n_episode :4160, score : 332.0, n_buffer : 50000, eps : 1.0%
n_episode :4180, score : 437.9, n_buffer : 50000, eps : 1.0%
n_episode :4200, score : 444.9, n_buffer : 50000, eps : 1.0%
n_episode :4220, score : 466.1, n_buffer : 50000, eps : 1.0%
n_episode :4240, score : 439.4, n_buffer : 50000, eps : 1.0%
```

```
n_episode :4260, score : 437.6, n_buffer : 50000, eps : 1.0%
n_episode :4280, score : 320.1, n_buffer : 50000, eps : 1.0%
n_episode :4300, score : 320.4, n_buffer : 50000, eps : 1.0%
n_episode :4320, score : 401.8, n_buffer : 50000, eps : 1.0%
n_episode :4340, score : 400.3, n_buffer : 50000, eps : 1.0%
n_episode :4360, score : 479.2, n_buffer : 50000, eps : 1.0%
n_episode :4380, score : 433.5, n_buffer : 50000, eps : 1.0%
n_episode :4400, score : 371.1, n_buffer : 50000, eps : 1.0%
n_episode :4420, score : 196.2, n_buffer : 50000, eps : 1.0%
n_episode :4440, score : 201.6, n_buffer : 50000, eps : 1.0%
n_episode :4460, score : 203.6, n_buffer : 50000, eps : 1.0%
n_episode :4480, score : 345.6, n_buffer : 50000, eps : 1.0%
n_episode :4500, score : 362.6, n_buffer : 50000, eps : 1.0%
n_episode :4520, score : 372.4, n_buffer : 50000, eps : 1.0%
n_episode :4540, score : 441.1, n_buffer : 50000, eps : 1.0%
n_episode :4560, score : 396.8, n_buffer : 50000, eps : 1.0%
n_episode :4580, score : 416.9, n_buffer : 50000, eps : 1.0%
n_episode :4600, score : 362.9, n_buffer : 50000, eps : 1.0%
n_episode :4620, score : 426.1, n_buffer : 50000, eps : 1.0%
n_episode :4640, score : 444.1, n_buffer : 50000, eps : 1.0%
n_episode :4660, score : 480.9, n_buffer : 50000, eps : 1.0%
n_episode :4680, score : 449.7, n_buffer : 50000, eps : 1.0%
n_episode :4700, score : 447.1, n_buffer : 50000, eps : 1.0%
n_episode :4720, score : 358.2, n_buffer : 50000, eps : 1.0%
n_episode :4740, score : 371.4, n_buffer : 50000, eps : 1.0%
n_episode :4760, score : 360.8, n_buffer : 50000, eps : 1.0%
n_episode :4780, score : 317.9, n_buffer : 50000, eps : 1.0%
n_episode :4800, score : 288.7, n_buffer : 50000, eps : 1.0%
n_episode :4820, score : 315.6, n_buffer : 50000, eps : 1.0%
n_episode :4840, score : 339.4, n_buffer : 50000, eps : 1.0%
n_episode :4860, score : 213.8, n_buffer : 50000, eps : 1.0%
n_episode :4880, score : 159.8, n_buffer : 50000, eps : 1.0%
n_episode :4900, score : 128.7, n_buffer : 50000, eps : 1.0%
n_episode :4920, score : 181.7, n_buffer : 50000, eps : 1.0%
n_episode :4940, score : 183.8, n_buffer : 50000, eps : 1.0%
n_episode :4960, score : 204.1, n_buffer : 50000, eps : 1.0%
n_episode :4980, score : 339.6, n_buffer : 50000, eps : 1.0%
n_episode :5000, score : 242.7, n_buffer : 50000, eps : 1.0%
n_episode :5020, score : 262.6, n_buffer : 50000, eps : 1.0%
n_episode :5040, score : 354.8, n_buffer : 50000, eps : 1.0%
n_episode :5060, score : 271.9, n_buffer : 50000, eps : 1.0%
n_episode :5080, score : 214.1, n_buffer : 50000, eps : 1.0%
n_episode :5100, score : 206.1, n_buffer : 50000, eps : 1.0%
n_episode :5120, score : 262.0, n_buffer : 50000, eps : 1.0%
n_episode :5140, score : 304.5, n_buffer : 50000, eps : 1.0%
n_episode :5160, score : 350.9, n_buffer : 50000, eps : 1.0%
n_episode :5180, score : 389.1, n_buffer : 50000, eps : 1.0%
n_episode :5200, score : 422.2, n_buffer : 50000, eps : 1.0%
```

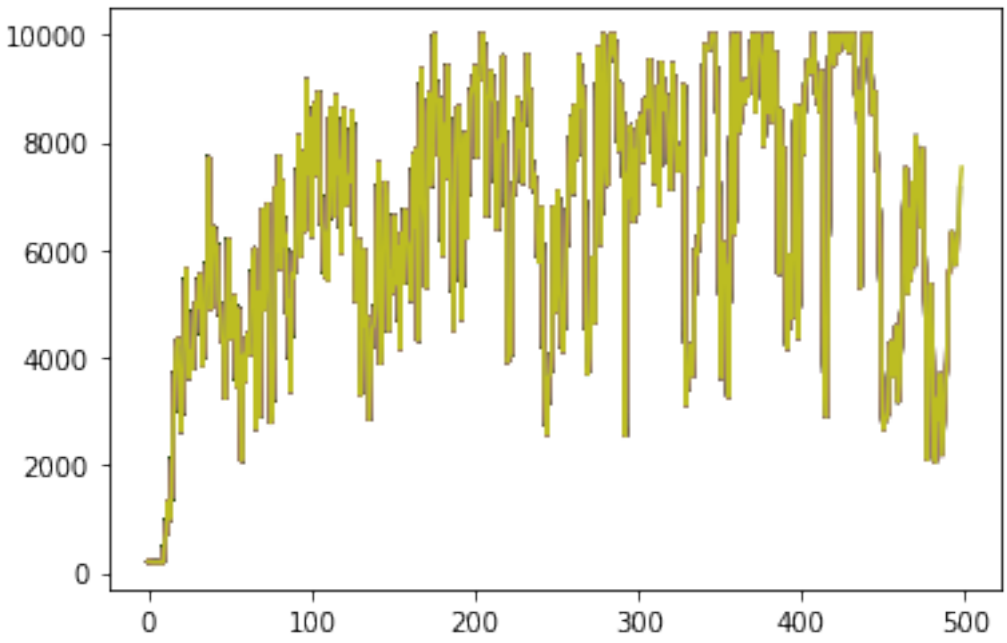
```
n_episode :5220, score : 353.1, n_buffer : 50000, eps : 1.0%
n_episode :5240, score : 434.0, n_buffer : 50000, eps : 1.0%
n_episode :5260, score : 384.5, n_buffer : 50000, eps : 1.0%
n_episode :5280, score : 391.4, n_buffer : 50000, eps : 1.0%
n_episode :5300, score : 479.7, n_buffer : 50000, eps : 1.0%
n_episode :5320, score : 433.0, n_buffer : 50000, eps : 1.0%
n_episode :5340, score : 450.8, n_buffer : 50000, eps : 1.0%
n_episode :5360, score : 431.9, n_buffer : 50000, eps : 1.0%
n_episode :5380, score : 240.1, n_buffer : 50000, eps : 1.0%
n_episode :5400, score : 184.5, n_buffer : 50000, eps : 1.0%
n_episode :5420, score : 200.4, n_buffer : 50000, eps : 1.0%
n_episode :5440, score : 241.5, n_buffer : 50000, eps : 1.0%
n_episode :5460, score : 292.8, n_buffer : 50000, eps : 1.0%
n_episode :5480, score : 232.2, n_buffer : 50000, eps : 1.0%
n_episode :5500, score : 318.6, n_buffer : 50000, eps : 1.0%
n_episode :5520, score : 488.1, n_buffer : 50000, eps : 1.0%
n_episode :5540, score : 458.2, n_buffer : 50000, eps : 1.0%
n_episode :5560, score : 305.4, n_buffer : 50000, eps : 1.0%
n_episode :5580, score : 408.8, n_buffer : 50000, eps : 1.0%
n_episode :5600, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :5620, score : 387.2, n_buffer : 50000, eps : 1.0%
n_episode :5640, score : 360.6, n_buffer : 50000, eps : 1.0%
n_episode :5660, score : 468.5, n_buffer : 50000, eps : 1.0%
n_episode :5680, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :5700, score : 480.9, n_buffer : 50000, eps : 1.0%
n_episode :5720, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :5740, score : 485.5, n_buffer : 50000, eps : 1.0%
n_episode :5760, score : 462.9, n_buffer : 50000, eps : 1.0%
n_episode :5780, score : 392.6, n_buffer : 50000, eps : 1.0%
n_episode :5800, score : 453.6, n_buffer : 50000, eps : 1.0%
n_episode :5820, score : 430.0, n_buffer : 50000, eps : 1.0%
n_episode :5840, score : 419.4, n_buffer : 50000, eps : 1.0%
n_episode :5860, score : 127.5, n_buffer : 50000, eps : 1.0%
n_episode :5880, score : 370.6, n_buffer : 50000, eps : 1.0%
n_episode :5900, score : 349.5, n_buffer : 50000, eps : 1.0%
n_episode :5920, score : 414.5, n_buffer : 50000, eps : 1.0%
n_episode :5940, score : 408.1, n_buffer : 50000, eps : 1.0%
n_episode :5960, score : 326.6, n_buffer : 50000, eps : 1.0%
n_episode :5980, score : 392.8, n_buffer : 50000, eps : 1.0%
n_episode :6000, score : 333.9, n_buffer : 50000, eps : 1.0%
n_episode :6020, score : 419.4, n_buffer : 50000, eps : 1.0%
n_episode :6040, score : 418.9, n_buffer : 50000, eps : 1.0%
n_episode :6060, score : 424.6, n_buffer : 50000, eps : 1.0%
n_episode :6080, score : 382.4, n_buffer : 50000, eps : 1.0%
n_episode :6100, score : 439.4, n_buffer : 50000, eps : 1.0%
n_episode :6120, score : 432.1, n_buffer : 50000, eps : 1.0%
n_episode :6140, score : 432.8, n_buffer : 50000, eps : 1.0%
n_episode :6160, score : 476.2, n_buffer : 50000, eps : 1.0%
```

```
n_episode :6180, score : 446.6, n_buffer : 50000, eps : 1.0%
n_episode :6200, score : 395.5, n_buffer : 50000, eps : 1.0%
n_episode :6220, score : 362.9, n_buffer : 50000, eps : 1.0%
n_episode :6240, score : 390.1, n_buffer : 50000, eps : 1.0%
n_episode :6260, score : 451.9, n_buffer : 50000, eps : 1.0%
n_episode :6280, score : 341.2, n_buffer : 50000, eps : 1.0%
n_episode :6300, score : 473.9, n_buffer : 50000, eps : 1.0%
n_episode :6320, score : 456.8, n_buffer : 50000, eps : 1.0%
n_episode :6340, score : 429.9, n_buffer : 50000, eps : 1.0%
n_episode :6360, score : 442.8, n_buffer : 50000, eps : 1.0%
n_episode :6380, score : 417.6, n_buffer : 50000, eps : 1.0%
n_episode :6400, score : 380.9, n_buffer : 50000, eps : 1.0%
n_episode :6420, score : 356.4, n_buffer : 50000, eps : 1.0%
n_episode :6440, score : 472.1, n_buffer : 50000, eps : 1.0%
n_episode :6460, score : 451.1, n_buffer : 50000, eps : 1.0%
n_episode :6480, score : 402.1, n_buffer : 50000, eps : 1.0%
n_episode :6500, score : 373.3, n_buffer : 50000, eps : 1.0%
n_episode :6520, score : 394.6, n_buffer : 50000, eps : 1.0%
n_episode :6540, score : 393.1, n_buffer : 50000, eps : 1.0%
n_episode :6560, score : 372.4, n_buffer : 50000, eps : 1.0%
n_episode :6580, score : 453.0, n_buffer : 50000, eps : 1.0%
n_episode :6600, score : 156.1, n_buffer : 50000, eps : 1.0%
n_episode :6620, score : 176.3, n_buffer : 50000, eps : 1.0%
n_episode :6640, score : 184.0, n_buffer : 50000, eps : 1.0%
n_episode :6660, score : 211.4, n_buffer : 50000, eps : 1.0%
n_episode :6680, score : 183.1, n_buffer : 50000, eps : 1.0%
n_episode :6700, score : 212.1, n_buffer : 50000, eps : 1.0%
n_episode :6720, score : 299.1, n_buffer : 50000, eps : 1.0%
n_episode :6740, score : 295.6, n_buffer : 50000, eps : 1.0%
n_episode :6760, score : 313.8, n_buffer : 50000, eps : 1.0%
n_episode :6780, score : 355.1, n_buffer : 50000, eps : 1.0%
n_episode :6800, score : 326.2, n_buffer : 50000, eps : 1.0%
n_episode :6820, score : 465.1, n_buffer : 50000, eps : 1.0%
n_episode :6840, score : 490.6, n_buffer : 50000, eps : 1.0%
n_episode :6860, score : 485.9, n_buffer : 50000, eps : 1.0%
n_episode :6880, score : 486.1, n_buffer : 50000, eps : 1.0%
n_episode :6900, score : 487.8, n_buffer : 50000, eps : 1.0%
n_episode :6920, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :6940, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :6960, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :6980, score : 453.1, n_buffer : 50000, eps : 1.0%
n_episode :7000, score : 395.7, n_buffer : 50000, eps : 1.0%
n_episode :7020, score : 265.9, n_buffer : 50000, eps : 1.0%
n_episode :7040, score : 181.7, n_buffer : 50000, eps : 1.0%
n_episode :7060, score : 306.7, n_buffer : 50000, eps : 1.0%
n_episode :7080, score : 286.9, n_buffer : 50000, eps : 1.0%
n_episode :7100, score : 284.0, n_buffer : 50000, eps : 1.0%
n_episode :7120, score : 163.4, n_buffer : 50000, eps : 1.0%
```

```
n_episode :7140, score : 273.2, n_buffer : 50000, eps : 1.0%
n_episode :7160, score : 483.9, n_buffer : 50000, eps : 1.0%
n_episode :7180, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :7200, score : 314.8, n_buffer : 50000, eps : 1.0%
n_episode :7220, score : 446.1, n_buffer : 50000, eps : 1.0%
n_episode :7240, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :7260, score : 410.1, n_buffer : 50000, eps : 1.0%
n_episode :7280, score : 430.9, n_buffer : 50000, eps : 1.0%
n_episode :7300, score : 454.8, n_buffer : 50000, eps : 1.0%
n_episode :7320, score : 436.6, n_buffer : 50000, eps : 1.0%
n_episode :7340, score : 457.4, n_buffer : 50000, eps : 1.0%
n_episode :7360, score : 442.8, n_buffer : 50000, eps : 1.0%
n_episode :7380, score : 448.4, n_buffer : 50000, eps : 1.0%
n_episode :7400, score : 480.9, n_buffer : 50000, eps : 1.0%
n_episode :7420, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :7440, score : 483.0, n_buffer : 50000, eps : 1.0%
n_episode :7460, score : 427.9, n_buffer : 50000, eps : 1.0%
n_episode :7480, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :7500, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :7520, score : 482.4, n_buffer : 50000, eps : 1.0%
n_episode :7540, score : 472.8, n_buffer : 50000, eps : 1.0%
n_episode :7560, score : 396.7, n_buffer : 50000, eps : 1.0%
n_episode :7580, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :7600, score : 448.5, n_buffer : 50000, eps : 1.0%
n_episode :7620, score : 427.4, n_buffer : 50000, eps : 1.0%
n_episode :7640, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :7660, score : 418.9, n_buffer : 50000, eps : 1.0%
n_episode :7680, score : 450.4, n_buffer : 50000, eps : 1.0%
n_episode :7700, score : 483.1, n_buffer : 50000, eps : 1.0%
n_episode :7720, score : 427.4, n_buffer : 50000, eps : 1.0%
n_episode :7740, score : 278.4, n_buffer : 50000, eps : 1.0%
n_episode :7760, score : 429.8, n_buffer : 50000, eps : 1.0%
n_episode :7780, score : 389.3, n_buffer : 50000, eps : 1.0%
n_episode :7800, score : 394.2, n_buffer : 50000, eps : 1.0%
n_episode :7820, score : 298.6, n_buffer : 50000, eps : 1.0%
n_episode :7840, score : 208.5, n_buffer : 50000, eps : 1.0%
n_episode :7860, score : 229.2, n_buffer : 50000, eps : 1.0%
n_episode :7880, score : 295.3, n_buffer : 50000, eps : 1.0%
n_episode :7900, score : 237.0, n_buffer : 50000, eps : 1.0%
n_episode :7920, score : 309.6, n_buffer : 50000, eps : 1.0%
n_episode :7940, score : 434.3, n_buffer : 50000, eps : 1.0%
n_episode :7960, score : 306.6, n_buffer : 50000, eps : 1.0%
n_episode :7980, score : 218.4, n_buffer : 50000, eps : 1.0%
n_episode :8000, score : 296.8, n_buffer : 50000, eps : 1.0%
n_episode :8020, score : 432.9, n_buffer : 50000, eps : 1.0%
n_episode :8040, score : 389.9, n_buffer : 50000, eps : 1.0%
n_episode :8060, score : 449.7, n_buffer : 50000, eps : 1.0%
n_episode :8080, score : 459.2, n_buffer : 50000, eps : 1.0%
```

```
n_episode :8100, score : 475.8, n_buffer : 50000, eps : 1.0%
n_episode :8120, score : 475.9, n_buffer : 50000, eps : 1.0%
n_episode :8140, score : 464.9, n_buffer : 50000, eps : 1.0%
n_episode :8160, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :8180, score : 480.1, n_buffer : 50000, eps : 1.0%
n_episode :8200, score : 443.2, n_buffer : 50000, eps : 1.0%
n_episode :8220, score : 442.6, n_buffer : 50000, eps : 1.0%
n_episode :8240, score : 428.3, n_buffer : 50000, eps : 1.0%
n_episode :8260, score : 465.6, n_buffer : 50000, eps : 1.0%
n_episode :8280, score : 342.4, n_buffer : 50000, eps : 1.0%
n_episode :8300, score : 167.2, n_buffer : 50000, eps : 1.0%
n_episode :8320, score : 145.5, n_buffer : 50000, eps : 1.0%
n_episode :8340, score : 224.6, n_buffer : 50000, eps : 1.0%
n_episode :8360, score : 475.8, n_buffer : 50000, eps : 1.0%
n_episode :8380, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :8400, score : 487.4, n_buffer : 50000, eps : 1.0%
n_episode :8420, score : 471.9, n_buffer : 50000, eps : 1.0%
n_episode :8440, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :8460, score : 484.8, n_buffer : 50000, eps : 1.0%
n_episode :8480, score : 483.7, n_buffer : 50000, eps : 1.0%
n_episode :8500, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :8520, score : 494.4, n_buffer : 50000, eps : 1.0%
n_episode :8540, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :8560, score : 487.7, n_buffer : 50000, eps : 1.0%
n_episode :8580, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :8600, score : 484.1, n_buffer : 50000, eps : 1.0%
n_episode :8620, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :8640, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :8660, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :8680, score : 457.4, n_buffer : 50000, eps : 1.0%
n_episode :8700, score : 429.6, n_buffer : 50000, eps : 1.0%
n_episode :8720, score : 446.7, n_buffer : 50000, eps : 1.0%
n_episode :8740, score : 264.9, n_buffer : 50000, eps : 1.0%
n_episode :8760, score : 392.7, n_buffer : 50000, eps : 1.0%
n_episode :8780, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :8800, score : 480.4, n_buffer : 50000, eps : 1.0%
n_episode :8820, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :8840, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :8860, score : 500.0, n_buffer : 50000, eps : 1.0%
n_episode :8880, score : 426.8, n_buffer : 50000, eps : 1.0%
n_episode :8900, score : 444.1, n_buffer : 50000, eps : 1.0%
n_episode :8920, score : 446.8, n_buffer : 50000, eps : 1.0%
n_episode :8940, score : 376.7, n_buffer : 50000, eps : 1.0%
n_episode :8960, score : 370.1, n_buffer : 50000, eps : 1.0%
n_episode :8980, score : 298.2, n_buffer : 50000, eps : 1.0%
n_episode :9000, score : 189.6, n_buffer : 50000, eps : 1.0%
n_episode :9020, score : 133.1, n_buffer : 50000, eps : 1.0%
n_episode :9040, score : 142.2, n_buffer : 50000, eps : 1.0%
```

```
n_episode :9060, score : 142.8, n_buffer : 50000, eps : 1.0%
n_episode :9080, score : 150.2, n_buffer : 50000, eps : 1.0%
n_episode :9100, score : 210.6, n_buffer : 50000, eps : 1.0%
n_episode :9120, score : 215.0, n_buffer : 50000, eps : 1.0%
n_episode :9140, score : 182.5, n_buffer : 50000, eps : 1.0%
n_episode :9160, score : 192.6, n_buffer : 50000, eps : 1.0%
n_episode :9180, score : 228.8, n_buffer : 50000, eps : 1.0%
n_episode :9200, score : 159.4, n_buffer : 50000, eps : 1.0%
n_episode :9220, score : 175.4, n_buffer : 50000, eps : 1.0%
n_episode :9240, score : 231.7, n_buffer : 50000, eps : 1.0%
n_episode :9260, score : 266.3, n_buffer : 50000, eps : 1.0%
n_episode :9280, score : 346.6, n_buffer : 50000, eps : 1.0%
n_episode :9300, score : 375.6, n_buffer : 50000, eps : 1.0%
n_episode :9320, score : 259.4, n_buffer : 50000, eps : 1.0%
n_episode :9340, score : 337.8, n_buffer : 50000, eps : 1.0%
n_episode :9360, score : 272.4, n_buffer : 50000, eps : 1.0%
n_episode :9380, score : 362.4, n_buffer : 50000, eps : 1.0%
n_episode :9400, score : 285.3, n_buffer : 50000, eps : 1.0%
n_episode :9420, score : 404.8, n_buffer : 50000, eps : 1.0%
n_episode :9440, score : 381.1, n_buffer : 50000, eps : 1.0%
n_episode :9460, score : 346.2, n_buffer : 50000, eps : 1.0%
n_episode :9480, score : 321.4, n_buffer : 50000, eps : 1.0%
n_episode :9500, score : 393.7, n_buffer : 50000, eps : 1.0%
n_episode :9520, score : 309.6, n_buffer : 50000, eps : 1.0%
n_episode :9540, score : 247.4, n_buffer : 50000, eps : 1.0%
n_episode :9560, score : 105.2, n_buffer : 50000, eps : 1.0%
n_episode :9580, score : 206.7, n_buffer : 50000, eps : 1.0%
n_episode :9600, score : 267.6, n_buffer : 50000, eps : 1.0%
n_episode :9620, score : 225.8, n_buffer : 50000, eps : 1.0%
n_episode :9640, score : 116.5, n_buffer : 50000, eps : 1.0%
n_episode :9660, score : 103.0, n_buffer : 50000, eps : 1.0%
n_episode :9680, score : 162.4, n_buffer : 50000, eps : 1.0%
n_episode :9700, score : 143.7, n_buffer : 50000, eps : 1.0%
n_episode :9720, score : 184.3, n_buffer : 50000, eps : 1.0%
n_episode :9740, score : 109.8, n_buffer : 50000, eps : 1.0%
n_episode :9760, score : 141.3, n_buffer : 50000, eps : 1.0%
n_episode :9780, score : 174.7, n_buffer : 50000, eps : 1.0%
n_episode :9800, score : 195.3, n_buffer : 50000, eps : 1.0%
n_episode :9820, score : 277.4, n_buffer : 50000, eps : 1.0%
n_episode :9840, score : 283.8, n_buffer : 50000, eps : 1.0%
n_episode :9860, score : 316.5, n_buffer : 50000, eps : 1.0%
n_episode :9880, score : 306.4, n_buffer : 50000, eps : 1.0%
n_episode :9900, score : 285.9, n_buffer : 50000, eps : 1.0%
n_episode :9920, score : 299.1, n_buffer : 50000, eps : 1.0%
n_episode :9940, score : 316.5, n_buffer : 50000, eps : 1.0%
n_episode :9960, score : 357.5, n_buffer : 50000, eps : 1.0%
n_episode :9980, score : 376.4, n_buffer : 50000, eps : 1.0%
```



When we change the value of epsilon to fixed values {0.01, 0.1} we can see that the learning is better at the beginning.

[ ]:
```
#BUFFER LIMIT changed to from 50000 to 5000

#Hyperparameters
learning_rate = 0.0005
gamma         = 0.98
buffer_limit  = 5000
batch_size    = 32

if __name__ == '__main__':
    main()
    plt.show()
```

```
n_episode :20, score : 10.7, n_buffer : 213, eps : 7.9%
n_episode :40, score : 10.1, n_buffer : 415, eps : 7.8%
n_episode :60, score : 9.8, n_buffer : 611, eps : 7.7%
n_episode :80, score : 10.1, n_buffer : 813, eps : 7.6%
n_episode :100, score : 9.9, n_buffer : 1012, eps : 7.5%
n_episode :120, score : 9.6, n_buffer : 1203, eps : 7.4%
n_episode :140, score : 9.6, n_buffer : 1395, eps : 7.3%
n_episode :160, score : 9.2, n_buffer : 1579, eps : 7.2%
n_episode :180, score : 9.3, n_buffer : 1765, eps : 7.1%
n_episode :200, score : 10.2, n_buffer : 1968, eps : 7.0%
n_episode :220, score : 17.8, n_buffer : 2323, eps : 6.9%
```

```
n_episode :240, score : 20.1, n_buffer : 2726, eps : 6.8%
n_episode :260, score : 9.6, n_buffer : 2917, eps : 6.7%
n_episode :280, score : 11.9, n_buffer : 3155, eps : 6.6%
n_episode :300, score : 14.2, n_buffer : 3438, eps : 6.5%
n_episode :320, score : 32.7, n_buffer : 4092, eps : 6.4%
n_episode :340, score : 84.2, n_buffer : 5000, eps : 6.3%
n_episode :360, score : 201.1, n_buffer : 5000, eps : 6.2%
n_episode :380, score : 162.5, n_buffer : 5000, eps : 6.1%
n_episode :400, score : 224.4, n_buffer : 5000, eps : 6.0%
n_episode :420, score : 207.6, n_buffer : 5000, eps : 5.9%
n_episode :440, score : 267.8, n_buffer : 5000, eps : 5.8%
n_episode :460, score : 295.6, n_buffer : 5000, eps : 5.7%
n_episode :480, score : 313.8, n_buffer : 5000, eps : 5.6%
n_episode :500, score : 290.8, n_buffer : 5000, eps : 5.5%
n_episode :520, score : 108.0, n_buffer : 5000, eps : 5.4%
n_episode :540, score : 246.1, n_buffer : 5000, eps : 5.3%
n_episode :560, score : 290.9, n_buffer : 5000, eps : 5.2%
n_episode :580, score : 270.1, n_buffer : 5000, eps : 5.1%
n_episode :600, score : 266.8, n_buffer : 5000, eps : 5.0%
n_episode :620, score : 336.1, n_buffer : 5000, eps : 4.9%
n_episode :640, score : 234.0, n_buffer : 5000, eps : 4.8%
n_episode :660, score : 311.6, n_buffer : 5000, eps : 4.7%
n_episode :680, score : 405.6, n_buffer : 5000, eps : 4.6%
n_episode :700, score : 333.6, n_buffer : 5000, eps : 4.5%
n_episode :720, score : 412.4, n_buffer : 5000, eps : 4.4%
n_episode :740, score : 452.1, n_buffer : 5000, eps : 4.3%
n_episode :760, score : 220.6, n_buffer : 5000, eps : 4.2%
n_episode :780, score : 192.2, n_buffer : 5000, eps : 4.1%
n_episode :800, score : 181.3, n_buffer : 5000, eps : 4.0%
n_episode :820, score : 211.4, n_buffer : 5000, eps : 3.9%
n_episode :840, score : 237.7, n_buffer : 5000, eps : 3.8%
n_episode :860, score : 147.6, n_buffer : 5000, eps : 3.7%
n_episode :880, score : 192.7, n_buffer : 5000, eps : 3.6%
n_episode :900, score : 157.9, n_buffer : 5000, eps : 3.5%
n_episode :920, score : 148.8, n_buffer : 5000, eps : 3.4%
n_episode :940, score : 188.8, n_buffer : 5000, eps : 3.3%
n_episode :960, score : 121.0, n_buffer : 5000, eps : 3.2%
n_episode :980, score : 94.4, n_buffer : 5000, eps : 3.1%
n_episode :1000, score : 178.4, n_buffer : 5000, eps : 3.0%
n_episode :1020, score : 257.5, n_buffer : 5000, eps : 2.9%
n_episode :1040, score : 266.9, n_buffer : 5000, eps : 2.8%
n_episode :1060, score : 320.9, n_buffer : 5000, eps : 2.7%
n_episode :1080, score : 297.1, n_buffer : 5000, eps : 2.6%
n_episode :1100, score : 380.6, n_buffer : 5000, eps : 2.5%
n_episode :1120, score : 310.0, n_buffer : 5000, eps : 2.4%
n_episode :1140, score : 277.2, n_buffer : 5000, eps : 2.3%
n_episode :1160, score : 357.5, n_buffer : 5000, eps : 2.2%
n_episode :1180, score : 382.7, n_buffer : 5000, eps : 2.1%
```

```
n_episode :1200, score : 268.9, n_buffer : 5000, eps : 2.0%
n_episode :1220, score : 257.4, n_buffer : 5000, eps : 1.9%
n_episode :1240, score : 288.3, n_buffer : 5000, eps : 1.8%
n_episode :1260, score : 221.8, n_buffer : 5000, eps : 1.7%
n_episode :1280, score : 235.3, n_buffer : 5000, eps : 1.6%
n_episode :1300, score : 281.4, n_buffer : 5000, eps : 1.5%
n_episode :1320, score : 287.1, n_buffer : 5000, eps : 1.4%
n_episode :1340, score : 266.4, n_buffer : 5000, eps : 1.3%
n_episode :1360, score : 164.4, n_buffer : 5000, eps : 1.2%
n_episode :1380, score : 211.4, n_buffer : 5000, eps : 1.1%
n_episode :1400, score : 144.2, n_buffer : 5000, eps : 1.0%
n_episode :1420, score : 127.8, n_buffer : 5000, eps : 1.0%
n_episode :1440, score : 132.6, n_buffer : 5000, eps : 1.0%
n_episode :1460, score : 130.3, n_buffer : 5000, eps : 1.0%
n_episode :1480, score : 149.9, n_buffer : 5000, eps : 1.0%
n_episode :1500, score : 178.9, n_buffer : 5000, eps : 1.0%
n_episode :1520, score : 165.8, n_buffer : 5000, eps : 1.0%
n_episode :1540, score : 207.9, n_buffer : 5000, eps : 1.0%
n_episode :1560, score : 171.7, n_buffer : 5000, eps : 1.0%
n_episode :1580, score : 195.0, n_buffer : 5000, eps : 1.0%
n_episode :1600, score : 211.7, n_buffer : 5000, eps : 1.0%
n_episode :1620, score : 296.9, n_buffer : 5000, eps : 1.0%
n_episode :1640, score : 299.5, n_buffer : 5000, eps : 1.0%
n_episode :1660, score : 297.6, n_buffer : 5000, eps : 1.0%
n_episode :1680, score : 250.5, n_buffer : 5000, eps : 1.0%
n_episode :1700, score : 226.8, n_buffer : 5000, eps : 1.0%
n_episode :1720, score : 267.4, n_buffer : 5000, eps : 1.0%
n_episode :1740, score : 254.6, n_buffer : 5000, eps : 1.0%
n_episode :1760, score : 217.2, n_buffer : 5000, eps : 1.0%
n_episode :1780, score : 215.8, n_buffer : 5000, eps : 1.0%
n_episode :1800, score : 193.2, n_buffer : 5000, eps : 1.0%
n_episode :1820, score : 221.0, n_buffer : 5000, eps : 1.0%
n_episode :1840, score : 190.9, n_buffer : 5000, eps : 1.0%
n_episode :1860, score : 119.5, n_buffer : 5000, eps : 1.0%
n_episode :1880, score : 266.1, n_buffer : 5000, eps : 1.0%
n_episode :1900, score : 252.7, n_buffer : 5000, eps : 1.0%
n_episode :1920, score : 234.8, n_buffer : 5000, eps : 1.0%
n_episode :1940, score : 257.6, n_buffer : 5000, eps : 1.0%
n_episode :1960, score : 218.8, n_buffer : 5000, eps : 1.0%
n_episode :1980, score : 212.6, n_buffer : 5000, eps : 1.0%
n_episode :2000, score : 207.2, n_buffer : 5000, eps : 1.0%
n_episode :2020, score : 210.3, n_buffer : 5000, eps : 1.0%
n_episode :2040, score : 192.0, n_buffer : 5000, eps : 1.0%
n_episode :2060, score : 161.8, n_buffer : 5000, eps : 1.0%
n_episode :2080, score : 150.9, n_buffer : 5000, eps : 1.0%
n_episode :2100, score : 152.1, n_buffer : 5000, eps : 1.0%
n_episode :2120, score : 265.3, n_buffer : 5000, eps : 1.0%
n_episode :2140, score : 227.3, n_buffer : 5000, eps : 1.0%
```

```
n_episode :2160, score : 215.8, n_buffer : 5000, eps : 1.0%
n_episode :2180, score : 260.4, n_buffer : 5000, eps : 1.0%
n_episode :2200, score : 174.2, n_buffer : 5000, eps : 1.0%
n_episode :2220, score : 196.3, n_buffer : 5000, eps : 1.0%
n_episode :2240, score : 155.8, n_buffer : 5000, eps : 1.0%
n_episode :2260, score : 243.9, n_buffer : 5000, eps : 1.0%
n_episode :2280, score : 190.0, n_buffer : 5000, eps : 1.0%
n_episode :2300, score : 169.9, n_buffer : 5000, eps : 1.0%
n_episode :2320, score : 250.8, n_buffer : 5000, eps : 1.0%
n_episode :2340, score : 361.4, n_buffer : 5000, eps : 1.0%
n_episode :2360, score : 238.8, n_buffer : 5000, eps : 1.0%
n_episode :2380, score : 277.2, n_buffer : 5000, eps : 1.0%
n_episode :2400, score : 299.8, n_buffer : 5000, eps : 1.0%
n_episode :2420, score : 300.1, n_buffer : 5000, eps : 1.0%
n_episode :2440, score : 333.8, n_buffer : 5000, eps : 1.0%
n_episode :2460, score : 199.7, n_buffer : 5000, eps : 1.0%
n_episode :2480, score : 322.8, n_buffer : 5000, eps : 1.0%
n_episode :2500, score : 166.9, n_buffer : 5000, eps : 1.0%
n_episode :2520, score : 254.2, n_buffer : 5000, eps : 1.0%
n_episode :2540, score : 348.9, n_buffer : 5000, eps : 1.0%
n_episode :2560, score : 325.2, n_buffer : 5000, eps : 1.0%
n_episode :2580, score : 238.1, n_buffer : 5000, eps : 1.0%
n_episode :2600, score : 212.3, n_buffer : 5000, eps : 1.0%
n_episode :2620, score : 302.9, n_buffer : 5000, eps : 1.0%
n_episode :2640, score : 245.2, n_buffer : 5000, eps : 1.0%
n_episode :2660, score : 350.6, n_buffer : 5000, eps : 1.0%
n_episode :2680, score : 305.9, n_buffer : 5000, eps : 1.0%
n_episode :2700, score : 295.7, n_buffer : 5000, eps : 1.0%
n_episode :2720, score : 317.4, n_buffer : 5000, eps : 1.0%
n_episode :2740, score : 278.4, n_buffer : 5000, eps : 1.0%
n_episode :2760, score : 272.3, n_buffer : 5000, eps : 1.0%
n_episode :2780, score : 287.2, n_buffer : 5000, eps : 1.0%
n_episode :2800, score : 327.4, n_buffer : 5000, eps : 1.0%
n_episode :2820, score : 316.9, n_buffer : 5000, eps : 1.0%
n_episode :2840, score : 388.9, n_buffer : 5000, eps : 1.0%
n_episode :2860, score : 364.8, n_buffer : 5000, eps : 1.0%
n_episode :2880, score : 342.7, n_buffer : 5000, eps : 1.0%
n_episode :2900, score : 312.6, n_buffer : 5000, eps : 1.0%
n_episode :2920, score : 263.8, n_buffer : 5000, eps : 1.0%
n_episode :2940, score : 267.1, n_buffer : 5000, eps : 1.0%
n_episode :2960, score : 284.6, n_buffer : 5000, eps : 1.0%
n_episode :2980, score : 276.9, n_buffer : 5000, eps : 1.0%
n_episode :3000, score : 317.9, n_buffer : 5000, eps : 1.0%
n_episode :3020, score : 334.1, n_buffer : 5000, eps : 1.0%
n_episode :3040, score : 367.9, n_buffer : 5000, eps : 1.0%
n_episode :3060, score : 340.8, n_buffer : 5000, eps : 1.0%
n_episode :3080, score : 383.9, n_buffer : 5000, eps : 1.0%
n_episode :3100, score : 342.4, n_buffer : 5000, eps : 1.0%
```

```
n_episode :3120, score : 386.3, n_buffer : 5000, eps : 1.0%
n_episode :3140, score : 455.9, n_buffer : 5000, eps : 1.0%
n_episode :3160, score : 414.3, n_buffer : 5000, eps : 1.0%
n_episode :3180, score : 414.9, n_buffer : 5000, eps : 1.0%
n_episode :3200, score : 411.6, n_buffer : 5000, eps : 1.0%
n_episode :3220, score : 434.6, n_buffer : 5000, eps : 1.0%
n_episode :3240, score : 391.8, n_buffer : 5000, eps : 1.0%
n_episode :3260, score : 307.8, n_buffer : 5000, eps : 1.0%
n_episode :3280, score : 275.1, n_buffer : 5000, eps : 1.0%
n_episode :3300, score : 259.1, n_buffer : 5000, eps : 1.0%
n_episode :3320, score : 265.1, n_buffer : 5000, eps : 1.0%
n_episode :3340, score : 250.2, n_buffer : 5000, eps : 1.0%
n_episode :3360, score : 225.6, n_buffer : 5000, eps : 1.0%
n_episode :3380, score : 237.1, n_buffer : 5000, eps : 1.0%
n_episode :3400, score : 225.3, n_buffer : 5000, eps : 1.0%
n_episode :3420, score : 217.2, n_buffer : 5000, eps : 1.0%
n_episode :3440, score : 205.3, n_buffer : 5000, eps : 1.0%
n_episode :3460, score : 196.4, n_buffer : 5000, eps : 1.0%
n_episode :3480, score : 194.9, n_buffer : 5000, eps : 1.0%
n_episode :3500, score : 189.1, n_buffer : 5000, eps : 1.0%
n_episode :3520, score : 197.8, n_buffer : 5000, eps : 1.0%
n_episode :3540, score : 197.3, n_buffer : 5000, eps : 1.0%
n_episode :3560, score : 193.9, n_buffer : 5000, eps : 1.0%
n_episode :3580, score : 186.2, n_buffer : 5000, eps : 1.0%
n_episode :3600, score : 193.8, n_buffer : 5000, eps : 1.0%
n_episode :3620, score : 194.6, n_buffer : 5000, eps : 1.0%
n_episode :3640, score : 192.6, n_buffer : 5000, eps : 1.0%
n_episode :3660, score : 198.8, n_buffer : 5000, eps : 1.0%
n_episode :3680, score : 220.5, n_buffer : 5000, eps : 1.0%
n_episode :3700, score : 252.2, n_buffer : 5000, eps : 1.0%
n_episode :3720, score : 264.1, n_buffer : 5000, eps : 1.0%
n_episode :3740, score : 366.4, n_buffer : 5000, eps : 1.0%
n_episode :3760, score : 305.7, n_buffer : 5000, eps : 1.0%
n_episode :3780, score : 85.7, n_buffer : 5000, eps : 1.0%
n_episode :3800, score : 220.7, n_buffer : 5000, eps : 1.0%
n_episode :3820, score : 265.6, n_buffer : 5000, eps : 1.0%
n_episode :3840, score : 266.0, n_buffer : 5000, eps : 1.0%
n_episode :3860, score : 294.7, n_buffer : 5000, eps : 1.0%
n_episode :3880, score : 319.1, n_buffer : 5000, eps : 1.0%
n_episode :3900, score : 331.3, n_buffer : 5000, eps : 1.0%
n_episode :3920, score : 370.2, n_buffer : 5000, eps : 1.0%
n_episode :3940, score : 405.3, n_buffer : 5000, eps : 1.0%
n_episode :3960, score : 375.2, n_buffer : 5000, eps : 1.0%
n_episode :3980, score : 283.1, n_buffer : 5000, eps : 1.0%
n_episode :4000, score : 284.3, n_buffer : 5000, eps : 1.0%
n_episode :4020, score : 367.9, n_buffer : 5000, eps : 1.0%
n_episode :4040, score : 428.3, n_buffer : 5000, eps : 1.0%
n_episode :4060, score : 367.8, n_buffer : 5000, eps : 1.0%
```

```
n_episode :4080, score : 389.2, n_buffer : 5000, eps : 1.0%
n_episode :4100, score : 436.5, n_buffer : 5000, eps : 1.0%
n_episode :4120, score : 371.9, n_buffer : 5000, eps : 1.0%
n_episode :4140, score : 348.1, n_buffer : 5000, eps : 1.0%
n_episode :4160, score : 383.1, n_buffer : 5000, eps : 1.0%
n_episode :4180, score : 317.6, n_buffer : 5000, eps : 1.0%
n_episode :4200, score : 337.2, n_buffer : 5000, eps : 1.0%
n_episode :4220, score : 298.4, n_buffer : 5000, eps : 1.0%
n_episode :4240, score : 267.9, n_buffer : 5000, eps : 1.0%
n_episode :4260, score : 278.6, n_buffer : 5000, eps : 1.0%
n_episode :4280, score : 265.2, n_buffer : 5000, eps : 1.0%
n_episode :4300, score : 254.3, n_buffer : 5000, eps : 1.0%
n_episode :4320, score : 275.1, n_buffer : 5000, eps : 1.0%
n_episode :4340, score : 309.8, n_buffer : 5000, eps : 1.0%
n_episode :4360, score : 333.0, n_buffer : 5000, eps : 1.0%
n_episode :4380, score : 331.9, n_buffer : 5000, eps : 1.0%
n_episode :4400, score : 354.1, n_buffer : 5000, eps : 1.0%
n_episode :4420, score : 321.8, n_buffer : 5000, eps : 1.0%
n_episode :4440, score : 368.8, n_buffer : 5000, eps : 1.0%
n_episode :4460, score : 317.7, n_buffer : 5000, eps : 1.0%
n_episode :4480, score : 327.2, n_buffer : 5000, eps : 1.0%
n_episode :4500, score : 244.3, n_buffer : 5000, eps : 1.0%
n_episode :4520, score : 223.9, n_buffer : 5000, eps : 1.0%
n_episode :4540, score : 205.6, n_buffer : 5000, eps : 1.0%
n_episode :4560, score : 206.2, n_buffer : 5000, eps : 1.0%
n_episode :4580, score : 203.1, n_buffer : 5000, eps : 1.0%
n_episode :4600, score : 204.4, n_buffer : 5000, eps : 1.0%
n_episode :4620, score : 200.1, n_buffer : 5000, eps : 1.0%
n_episode :4640, score : 193.2, n_buffer : 5000, eps : 1.0%
n_episode :4660, score : 190.6, n_buffer : 5000, eps : 1.0%
n_episode :4680, score : 199.2, n_buffer : 5000, eps : 1.0%
n_episode :4700, score : 195.9, n_buffer : 5000, eps : 1.0%
n_episode :4720, score : 212.3, n_buffer : 5000, eps : 1.0%
n_episode :4740, score : 236.0, n_buffer : 5000, eps : 1.0%
n_episode :4760, score : 220.2, n_buffer : 5000, eps : 1.0%
n_episode :4780, score : 212.6, n_buffer : 5000, eps : 1.0%
n_episode :4800, score : 265.1, n_buffer : 5000, eps : 1.0%
n_episode :4820, score : 243.2, n_buffer : 5000, eps : 1.0%
n_episode :4840, score : 229.7, n_buffer : 5000, eps : 1.0%
n_episode :4860, score : 139.6, n_buffer : 5000, eps : 1.0%
n_episode :4880, score : 353.8, n_buffer : 5000, eps : 1.0%
n_episode :4900, score : 436.9, n_buffer : 5000, eps : 1.0%
n_episode :4920, score : 351.6, n_buffer : 5000, eps : 1.0%
n_episode :4940, score : 462.7, n_buffer : 5000, eps : 1.0%
n_episode :4960, score : 478.6, n_buffer : 5000, eps : 1.0%
n_episode :4980, score : 392.6, n_buffer : 5000, eps : 1.0%
n_episode :5000, score : 399.5, n_buffer : 5000, eps : 1.0%
n_episode :5020, score : 464.0, n_buffer : 5000, eps : 1.0%
```

```
n_episode :5040, score : 408.4, n_buffer : 5000, eps : 1.0%
n_episode :5060, score : 434.6, n_buffer : 5000, eps : 1.0%
n_episode :5080, score : 377.6, n_buffer : 5000, eps : 1.0%
n_episode :5100, score : 230.1, n_buffer : 5000, eps : 1.0%
n_episode :5120, score : 228.2, n_buffer : 5000, eps : 1.0%
n_episode :5140, score : 259.8, n_buffer : 5000, eps : 1.0%
n_episode :5160, score : 438.1, n_buffer : 5000, eps : 1.0%
n_episode :5180, score : 493.8, n_buffer : 5000, eps : 1.0%
n_episode :5200, score : 377.9, n_buffer : 5000, eps : 1.0%
n_episode :5220, score : 486.6, n_buffer : 5000, eps : 1.0%
n_episode :5240, score : 401.2, n_buffer : 5000, eps : 1.0%
n_episode :5260, score : 419.4, n_buffer : 5000, eps : 1.0%
n_episode :5280, score : 484.3, n_buffer : 5000, eps : 1.0%
n_episode :5300, score : 459.2, n_buffer : 5000, eps : 1.0%
n_episode :5320, score : 392.6, n_buffer : 5000, eps : 1.0%
n_episode :5340, score : 441.6, n_buffer : 5000, eps : 1.0%
n_episode :5360, score : 441.9, n_buffer : 5000, eps : 1.0%
n_episode :5380, score : 406.4, n_buffer : 5000, eps : 1.0%
n_episode :5400, score : 454.1, n_buffer : 5000, eps : 1.0%
n_episode :5420, score : 335.2, n_buffer : 5000, eps : 1.0%
n_episode :5440, score : 324.7, n_buffer : 5000, eps : 1.0%
n_episode :5460, score : 383.4, n_buffer : 5000, eps : 1.0%
n_episode :5480, score : 488.6, n_buffer : 5000, eps : 1.0%
n_episode :5500, score : 421.6, n_buffer : 5000, eps : 1.0%
n_episode :5520, score : 417.5, n_buffer : 5000, eps : 1.0%
n_episode :5540, score : 403.1, n_buffer : 5000, eps : 1.0%
n_episode :5560, score : 450.7, n_buffer : 5000, eps : 1.0%
n_episode :5580, score : 488.3, n_buffer : 5000, eps : 1.0%
n_episode :5600, score : 430.8, n_buffer : 5000, eps : 1.0%
n_episode :5620, score : 392.9, n_buffer : 5000, eps : 1.0%
n_episode :5640, score : 357.6, n_buffer : 5000, eps : 1.0%
n_episode :5660, score : 416.9, n_buffer : 5000, eps : 1.0%
n_episode :5680, score : 422.4, n_buffer : 5000, eps : 1.0%
n_episode :5700, score : 367.1, n_buffer : 5000, eps : 1.0%
n_episode :5720, score : 356.1, n_buffer : 5000, eps : 1.0%
n_episode :5740, score : 357.4, n_buffer : 5000, eps : 1.0%
n_episode :5760, score : 421.8, n_buffer : 5000, eps : 1.0%
n_episode :5780, score : 461.4, n_buffer : 5000, eps : 1.0%
n_episode :5800, score : 357.8, n_buffer : 5000, eps : 1.0%
n_episode :5820, score : 380.0, n_buffer : 5000, eps : 1.0%
n_episode :5840, score : 377.8, n_buffer : 5000, eps : 1.0%
n_episode :5860, score : 378.6, n_buffer : 5000, eps : 1.0%
n_episode :5880, score : 374.8, n_buffer : 5000, eps : 1.0%
n_episode :5900, score : 333.4, n_buffer : 5000, eps : 1.0%
n_episode :5920, score : 449.4, n_buffer : 5000, eps : 1.0%
n_episode :5940, score : 284.8, n_buffer : 5000, eps : 1.0%
n_episode :5960, score : 245.1, n_buffer : 5000, eps : 1.0%
n_episode :5980, score : 317.5, n_buffer : 5000, eps : 1.0%
```

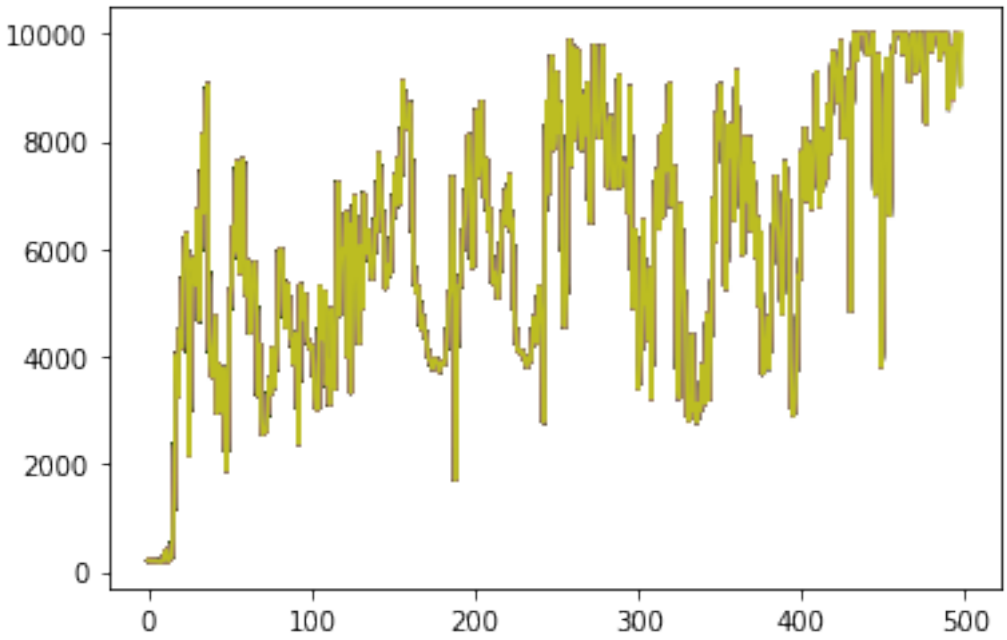
```
n_episode :6000, score : 303.8, n_buffer : 5000, eps : 1.0%
n_episode :6020, score : 170.0, n_buffer : 5000, eps : 1.0%
n_episode :6040, score : 193.9, n_buffer : 5000, eps : 1.0%
n_episode :6060, score : 210.8, n_buffer : 5000, eps : 1.0%
n_episode :6080, score : 326.8, n_buffer : 5000, eps : 1.0%
n_episode :6100, score : 248.8, n_buffer : 5000, eps : 1.0%
n_episode :6120, score : 255.6, n_buffer : 5000, eps : 1.0%
n_episode :6140, score : 215.3, n_buffer : 5000, eps : 1.0%
n_episode :6160, score : 281.6, n_buffer : 5000, eps : 1.0%
n_episode :6180, score : 160.9, n_buffer : 5000, eps : 1.0%
n_episode :6200, score : 246.1, n_buffer : 5000, eps : 1.0%
n_episode :6220, score : 333.0, n_buffer : 5000, eps : 1.0%
n_episode :6240, score : 369.6, n_buffer : 5000, eps : 1.0%
n_episode :6260, score : 373.1, n_buffer : 5000, eps : 1.0%
n_episode :6280, score : 318.6, n_buffer : 5000, eps : 1.0%
n_episode :6300, score : 405.7, n_buffer : 5000, eps : 1.0%
n_episode :6320, score : 329.9, n_buffer : 5000, eps : 1.0%
n_episode :6340, score : 414.4, n_buffer : 5000, eps : 1.0%
n_episode :6360, score : 372.2, n_buffer : 5000, eps : 1.0%
n_episode :6380, score : 388.1, n_buffer : 5000, eps : 1.0%
n_episode :6400, score : 453.2, n_buffer : 5000, eps : 1.0%
n_episode :6420, score : 340.6, n_buffer : 5000, eps : 1.0%
n_episode :6440, score : 362.9, n_buffer : 5000, eps : 1.0%
n_episode :6460, score : 376.1, n_buffer : 5000, eps : 1.0%
n_episode :6480, score : 316.9, n_buffer : 5000, eps : 1.0%
n_episode :6500, score : 173.2, n_buffer : 5000, eps : 1.0%
n_episode :6520, score : 161.6, n_buffer : 5000, eps : 1.0%
n_episode :6540, score : 341.7, n_buffer : 5000, eps : 1.0%
n_episode :6560, score : 278.3, n_buffer : 5000, eps : 1.0%
n_episode :6580, score : 260.2, n_buffer : 5000, eps : 1.0%
n_episode :6600, score : 230.2, n_buffer : 5000, eps : 1.0%
n_episode :6620, score : 146.1, n_buffer : 5000, eps : 1.0%
n_episode :6640, score : 140.1, n_buffer : 5000, eps : 1.0%
n_episode :6660, score : 144.3, n_buffer : 5000, eps : 1.0%
n_episode :6680, score : 219.9, n_buffer : 5000, eps : 1.0%
n_episode :6700, score : 149.6, n_buffer : 5000, eps : 1.0%
n_episode :6720, score : 156.1, n_buffer : 5000, eps : 1.0%
n_episode :6740, score : 139.4, n_buffer : 5000, eps : 1.0%
n_episode :6760, score : 155.9, n_buffer : 5000, eps : 1.0%
n_episode :6780, score : 150.4, n_buffer : 5000, eps : 1.0%
n_episode :6800, score : 191.8, n_buffer : 5000, eps : 1.0%
n_episode :6820, score : 156.3, n_buffer : 5000, eps : 1.0%
n_episode :6840, score : 156.8, n_buffer : 5000, eps : 1.0%
n_episode :6860, score : 239.7, n_buffer : 5000, eps : 1.0%
n_episode :6880, score : 159.9, n_buffer : 5000, eps : 1.0%
n_episode :6900, score : 198.2, n_buffer : 5000, eps : 1.0%
n_episode :6920, score : 255.6, n_buffer : 5000, eps : 1.0%
n_episode :6940, score : 346.1, n_buffer : 5000, eps : 1.0%
```

```
n_episode :6960, score : 307.1, n_buffer : 5000, eps : 1.0%
n_episode :6980, score : 425.2, n_buffer : 5000, eps : 1.0%
n_episode :7000, score : 401.1, n_buffer : 5000, eps : 1.0%
n_episode :7020, score : 452.1, n_buffer : 5000, eps : 1.0%
n_episode :7040, score : 424.6, n_buffer : 5000, eps : 1.0%
n_episode :7060, score : 417.4, n_buffer : 5000, eps : 1.0%
n_episode :7080, score : 269.1, n_buffer : 5000, eps : 1.0%
n_episode :7100, score : 263.4, n_buffer : 5000, eps : 1.0%
n_episode :7120, score : 414.2, n_buffer : 5000, eps : 1.0%
n_episode :7140, score : 386.2, n_buffer : 5000, eps : 1.0%
n_episode :7160, score : 415.4, n_buffer : 5000, eps : 1.0%
n_episode :7180, score : 378.8, n_buffer : 5000, eps : 1.0%
n_episode :7200, score : 326.4, n_buffer : 5000, eps : 1.0%
n_episode :7220, score : 465.1, n_buffer : 5000, eps : 1.0%
n_episode :7240, score : 418.1, n_buffer : 5000, eps : 1.0%
n_episode :7260, score : 383.1, n_buffer : 5000, eps : 1.0%
n_episode :7280, score : 353.4, n_buffer : 5000, eps : 1.0%
n_episode :7300, score : 294.6, n_buffer : 5000, eps : 1.0%
n_episode :7320, score : 403.9, n_buffer : 5000, eps : 1.0%
n_episode :7340, score : 397.0, n_buffer : 5000, eps : 1.0%
n_episode :7360, score : 344.0, n_buffer : 5000, eps : 1.0%
n_episode :7380, score : 402.8, n_buffer : 5000, eps : 1.0%
n_episode :7400, score : 317.1, n_buffer : 5000, eps : 1.0%
n_episode :7420, score : 377.8, n_buffer : 5000, eps : 1.0%
n_episode :7440, score : 347.6, n_buffer : 5000, eps : 1.0%
n_episode :7460, score : 292.8, n_buffer : 5000, eps : 1.0%
n_episode :7480, score : 328.6, n_buffer : 5000, eps : 1.0%
n_episode :7500, score : 247.1, n_buffer : 5000, eps : 1.0%
n_episode :7520, score : 315.2, n_buffer : 5000, eps : 1.0%
n_episode :7540, score : 184.3, n_buffer : 5000, eps : 1.0%
n_episode :7560, score : 185.3, n_buffer : 5000, eps : 1.0%
n_episode :7580, score : 209.0, n_buffer : 5000, eps : 1.0%
n_episode :7600, score : 236.2, n_buffer : 5000, eps : 1.0%
n_episode :7620, score : 189.3, n_buffer : 5000, eps : 1.0%
n_episode :7640, score : 228.4, n_buffer : 5000, eps : 1.0%
n_episode :7660, score : 286.3, n_buffer : 5000, eps : 1.0%
n_episode :7680, score : 332.2, n_buffer : 5000, eps : 1.0%
n_episode :7700, score : 367.1, n_buffer : 5000, eps : 1.0%
n_episode :7720, score : 325.3, n_buffer : 5000, eps : 1.0%
n_episode :7740, score : 315.8, n_buffer : 5000, eps : 1.0%
n_episode :7760, score : 283.6, n_buffer : 5000, eps : 1.0%
n_episode :7780, score : 239.3, n_buffer : 5000, eps : 1.0%
n_episode :7800, score : 338.9, n_buffer : 5000, eps : 1.0%
n_episode :7820, score : 380.0, n_buffer : 5000, eps : 1.0%
n_episode :7840, score : 352.4, n_buffer : 5000, eps : 1.0%
n_episode :7860, score : 343.9, n_buffer : 5000, eps : 1.0%
n_episode :7880, score : 204.1, n_buffer : 5000, eps : 1.0%
n_episode :7900, score : 152.8, n_buffer : 5000, eps : 1.0%
```

```
n_episode :7920, score : 145.1, n_buffer : 5000, eps : 1.0%
n_episode :7940, score : 157.7, n_buffer : 5000, eps : 1.0%
n_episode :7960, score : 196.9, n_buffer : 5000, eps : 1.0%
n_episode :7980, score : 275.4, n_buffer : 5000, eps : 1.0%
n_episode :8000, score : 272.6, n_buffer : 5000, eps : 1.0%
n_episode :8020, score : 389.8, n_buffer : 5000, eps : 1.0%
n_episode :8040, score : 349.6, n_buffer : 5000, eps : 1.0%
n_episode :8060, score : 411.5, n_buffer : 5000, eps : 1.0%
n_episode :8080, score : 344.9, n_buffer : 5000, eps : 1.0%
n_episode :8100, score : 397.6, n_buffer : 5000, eps : 1.0%
n_episode :8120, score : 381.8, n_buffer : 5000, eps : 1.0%
n_episode :8140, score : 337.4, n_buffer : 5000, eps : 1.0%
n_episode :8160, score : 371.6, n_buffer : 5000, eps : 1.0%
n_episode :8180, score : 412.9, n_buffer : 5000, eps : 1.0%
n_episode :8200, score : 464.0, n_buffer : 5000, eps : 1.0%
n_episode :8220, score : 388.1, n_buffer : 5000, eps : 1.0%
n_episode :8240, score : 339.1, n_buffer : 5000, eps : 1.0%
n_episode :8260, score : 410.1, n_buffer : 5000, eps : 1.0%
n_episode :8280, score : 354.0, n_buffer : 5000, eps : 1.0%
n_episode :8300, score : 406.6, n_buffer : 5000, eps : 1.0%
n_episode :8320, score : 364.9, n_buffer : 5000, eps : 1.0%
n_episode :8340, score : 433.9, n_buffer : 5000, eps : 1.0%
n_episode :8360, score : 389.2, n_buffer : 5000, eps : 1.0%
n_episode :8380, score : 425.7, n_buffer : 5000, eps : 1.0%
n_episode :8400, score : 482.8, n_buffer : 5000, eps : 1.0%
n_episode :8420, score : 477.8, n_buffer : 5000, eps : 1.0%
n_episode :8440, score : 461.5, n_buffer : 5000, eps : 1.0%
n_episode :8460, score : 435.9, n_buffer : 5000, eps : 1.0%
n_episode :8480, score : 466.9, n_buffer : 5000, eps : 1.0%
n_episode :8500, score : 492.9, n_buffer : 5000, eps : 1.0%
n_episode :8520, score : 403.1, n_buffer : 5000, eps : 1.0%
n_episode :8540, score : 414.8, n_buffer : 5000, eps : 1.0%
n_episode :8560, score : 404.1, n_buffer : 5000, eps : 1.0%
n_episode :8580, score : 454.0, n_buffer : 5000, eps : 1.0%
n_episode :8600, score : 464.6, n_buffer : 5000, eps : 1.0%
n_episode :8620, score : 242.5, n_buffer : 5000, eps : 1.0%
n_episode :8640, score : 430.2, n_buffer : 5000, eps : 1.0%
n_episode :8660, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :8680, score : 492.4, n_buffer : 5000, eps : 1.0%
n_episode :8700, score : 475.4, n_buffer : 5000, eps : 1.0%
n_episode :8720, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :8740, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :8760, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :8780, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :8800, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :8820, score : 480.8, n_buffer : 5000, eps : 1.0%
n_episode :8840, score : 480.5, n_buffer : 5000, eps : 1.0%
n_episode :8860, score : 481.2, n_buffer : 5000, eps : 1.0%
```

```
n_episode :8880, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :8900, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :8920, score : 350.8, n_buffer : 5000, eps : 1.0%
n_episode :8940, score : 375.2, n_buffer : 5000, eps : 1.0%
n_episode :8960, score : 480.4, n_buffer : 5000, eps : 1.0%
n_episode :8980, score : 442.8, n_buffer : 5000, eps : 1.0%
n_episode :9000, score : 190.4, n_buffer : 5000, eps : 1.0%
n_episode :9020, score : 275.1, n_buffer : 5000, eps : 1.0%
n_episode :9040, score : 425.1, n_buffer : 5000, eps : 1.0%
n_episode :9060, score : 476.6, n_buffer : 5000, eps : 1.0%
n_episode :9080, score : 430.1, n_buffer : 5000, eps : 1.0%
n_episode :9100, score : 331.1, n_buffer : 5000, eps : 1.0%
n_episode :9120, score : 482.6, n_buffer : 5000, eps : 1.0%
n_episode :9140, score : 482.6, n_buffer : 5000, eps : 1.0%
n_episode :9160, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9180, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9200, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9220, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9240, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9260, score : 481.8, n_buffer : 5000, eps : 1.0%
n_episode :9280, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9300, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9320, score : 467.1, n_buffer : 5000, eps : 1.0%
n_episode :9340, score : 455.8, n_buffer : 5000, eps : 1.0%
n_episode :9360, score : 495.3, n_buffer : 5000, eps : 1.0%
n_episode :9380, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9400, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9420, score : 463.8, n_buffer : 5000, eps : 1.0%
n_episode :9440, score : 466.9, n_buffer : 5000, eps : 1.0%
n_episode :9460, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9480, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9500, score : 471.8, n_buffer : 5000, eps : 1.0%
n_episode :9520, score : 453.8, n_buffer : 5000, eps : 1.0%
n_episode :9540, score : 416.9, n_buffer : 5000, eps : 1.0%
n_episode :9560, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9580, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9600, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9620, score : 483.6, n_buffer : 5000, eps : 1.0%
n_episode :9640, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9660, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9680, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9700, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9720, score : 475.6, n_buffer : 5000, eps : 1.0%
n_episode :9740, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9760, score : 484.1, n_buffer : 5000, eps : 1.0%
n_episode :9780, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9800, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9820, score : 429.9, n_buffer : 5000, eps : 1.0%
```

```
n_episode :9840, score : 487.5, n_buffer : 5000, eps : 1.0%
n_episode :9860, score : 458.2, n_buffer : 5000, eps : 1.0%
n_episode :9880, score : 439.4, n_buffer : 5000, eps : 1.0%
n_episode :9900, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9920, score : 485.8, n_buffer : 5000, eps : 1.0%
n_episode :9940, score : 500.0, n_buffer : 5000, eps : 1.0%
n_episode :9960, score : 451.4, n_buffer : 5000, eps : 1.0%
n_episode :9980, score : 500.0, n_buffer : 5000, eps : 1.0%
```



when we change the buffer limit value from 50000 to 5000, we can see that the learning is better and the score values do not fluctuate as much.

[14]:
```
#BUFFER LIMIT changed to from 50000 to 10000

#Hyperparameters
learning_rate = 0.0005
gamma         = 0.98
buffer_limit  = 10000
batch_size    = 32

class ReplayBuffer():
    def __init__(self):
        self.buffer = collections.deque(maxlen=buffer_limit)

    def put(self, transition):
        self.buffer.append(transition)
```

```
    def sample(self, n):
        mini_batch = random.sample(self.buffer, n)
        s_lst, a_lst, r_lst, s_prime_lst, done_mask_lst = [], [], [], [], []

        for transition in mini_batch:
            s, a, r, s_prime, done_mask = transition
            s_lst.append(s)
            a_lst.append([a])
            r_lst.append([r])
            s_prime_lst.append(s_prime)
            done_mask_lst.append([done_mask])

        return torch.tensor(s_lst, dtype=torch.float), torch.tensor(a_lst), \
               torch.tensor(r_lst), torch.tensor(s_prime_lst, dtype=torch.
↪float), \
               torch.tensor(done_mask_lst)

    def size(self):
        return len(self.buffer)

class Qnet(nn.Module):
    def __init__(self):
        super(Qnet, self).__init__()
        self.fc1 = nn.Linear(4, 128)
        self.fc2 = nn.Linear(128, 128)
        self.fc3 = nn.Linear(128, 2)

    def forward(self, x):
        x = F.relu(self.fc1(x))
        x = F.relu(self.fc2(x))
        x = self.fc3(x)
        return x

    def sample_action(self, obs, epsilon):
        out = self.forward(obs)
        coin = random.random()
        if coin < epsilon:
            return random.randint(0,1)
        else :
            return out.argmax().item()

def train(q, q_target, memory, optimizer):
    for i in range(10):
        s,a,r,s_prime,done_mask = memory.sample(batch_size)

        q_out = q(s)
```

```
        q_a = q_out.gather(1,a)
        max_q_prime = q_target(s_prime).max(1)[0].unsqueeze(1)
        target = r + gamma * max_q_prime * done_mask
        loss = F.smooth_l1_loss(q_a, target)

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


def main():
    env = gym.make('CartPole-v1')
    q = Qnet()
    q_target = Qnet()
    q_target.load_state_dict(q.state_dict())
    memory = ReplayBuffer()

    print_interval = 20
    score = 0.0
    optimizer = optim.Adam(q.parameters(), lr=learning_rate)
    total_score = []
    list_epsilon = []

    for n_epi in range(10000):
        epsilon = max(0.01, 0.08 - 0.01*(n_epi/200)) #Linear annealing from 8%␣
↪to 1%
        s = env.reset()
        done = False

        while not done:
            a = q.sample_action(torch.from_numpy(s).float(), epsilon)
            s_prime, r, done, info = env.step(a)
            done_mask = 0.0 if done else 1.0
            memory.put((s,a,r/100.0,s_prime, done_mask))
            s = s_prime

            score += r
            if done:
                break

        if memory.size()>2000:
            train(q, q_target, memory, optimizer)

        if n_epi%print_interval==0 and n_epi!=0:
            q_target.load_state_dict(q.state_dict())
            print("n_episode :{}, score : {:.1f}, n_buffer : {}, eps : {:.1f}%".
↪format(
```

```
                                                                    n_epi, score/
↪print_interval, memory.size(), epsilon*100))

            total_score.append(score)
            list_epsilon.append(epsilon)
            plt.plot(total_score)

            score = 0.0
    env.close()

if __name__ == '__main__':
    main()
    plt.show()
```

```
n_episode :20, score : 11.4, n_buffer : 228, eps : 7.9%
n_episode :40, score : 11.1, n_buffer : 450, eps : 7.8%
n_episode :60, score : 11.3, n_buffer : 677, eps : 7.7%
n_episode :80, score : 11.7, n_buffer : 910, eps : 7.6%
n_episode :100, score : 11.1, n_buffer : 1131, eps : 7.5%
n_episode :120, score : 11.2, n_buffer : 1354, eps : 7.4%
n_episode :140, score : 11.4, n_buffer : 1582, eps : 7.3%
n_episode :160, score : 11.9, n_buffer : 1821, eps : 7.2%
n_episode :180, score : 11.1, n_buffer : 2043, eps : 7.1%
n_episode :200, score : 14.8, n_buffer : 2340, eps : 7.0%
n_episode :220, score : 12.2, n_buffer : 2583, eps : 6.9%
n_episode :240, score : 15.8, n_buffer : 2898, eps : 6.8%
n_episode :260, score : 18.4, n_buffer : 3267, eps : 6.7%
n_episode :280, score : 40.5, n_buffer : 4077, eps : 6.6%
n_episode :300, score : 118.8, n_buffer : 6452, eps : 6.5%
n_episode :320, score : 181.8, n_buffer : 10000, eps : 6.4%
n_episode :340, score : 143.1, n_buffer : 10000, eps : 6.3%
n_episode :360, score : 244.8, n_buffer : 10000, eps : 6.2%
n_episode :380, score : 228.3, n_buffer : 10000, eps : 6.1%
n_episode :400, score : 180.5, n_buffer : 10000, eps : 6.0%
n_episode :420, score : 223.4, n_buffer : 10000, eps : 5.9%
n_episode :440, score : 232.1, n_buffer : 10000, eps : 5.8%
n_episode :460, score : 161.4, n_buffer : 10000, eps : 5.7%
n_episode :480, score : 194.8, n_buffer : 10000, eps : 5.6%
n_episode :500, score : 200.4, n_buffer : 10000, eps : 5.5%
n_episode :520, score : 210.2, n_buffer : 10000, eps : 5.4%
n_episode :540, score : 166.6, n_buffer : 10000, eps : 5.3%
n_episode :560, score : 153.2, n_buffer : 10000, eps : 5.2%
n_episode :580, score : 189.7, n_buffer : 10000, eps : 5.1%
n_episode :600, score : 134.9, n_buffer : 10000, eps : 5.0%
n_episode :620, score : 166.7, n_buffer : 10000, eps : 4.9%
n_episode :640, score : 198.1, n_buffer : 10000, eps : 4.8%
n_episode :660, score : 200.7, n_buffer : 10000, eps : 4.7%
```

```
n_episode :680, score : 162.2, n_buffer : 10000, eps : 4.6%
n_episode :700, score : 179.8, n_buffer : 10000, eps : 4.5%
n_episode :720, score : 190.2, n_buffer : 10000, eps : 4.4%
n_episode :740, score : 194.0, n_buffer : 10000, eps : 4.3%
n_episode :760, score : 256.1, n_buffer : 10000, eps : 4.2%
n_episode :780, score : 202.9, n_buffer : 10000, eps : 4.1%
n_episode :800, score : 181.2, n_buffer : 10000, eps : 4.0%
n_episode :820, score : 188.9, n_buffer : 10000, eps : 3.9%
n_episode :840, score : 189.4, n_buffer : 10000, eps : 3.8%
n_episode :860, score : 131.0, n_buffer : 10000, eps : 3.7%
n_episode :880, score : 106.1, n_buffer : 10000, eps : 3.6%
n_episode :900, score : 182.5, n_buffer : 10000, eps : 3.5%
n_episode :920, score : 132.2, n_buffer : 10000, eps : 3.4%
n_episode :940, score : 132.8, n_buffer : 10000, eps : 3.3%
n_episode :960, score : 108.3, n_buffer : 10000, eps : 3.2%
n_episode :980, score : 158.1, n_buffer : 10000, eps : 3.1%
n_episode :1000, score : 103.0, n_buffer : 10000, eps : 3.0%
n_episode :1020, score : 172.5, n_buffer : 10000, eps : 2.9%
n_episode :1040, score : 140.8, n_buffer : 10000, eps : 2.8%
n_episode :1060, score : 131.9, n_buffer : 10000, eps : 2.7%
n_episode :1080, score : 146.3, n_buffer : 10000, eps : 2.6%
n_episode :1100, score : 246.8, n_buffer : 10000, eps : 2.5%
n_episode :1120, score : 292.4, n_buffer : 10000, eps : 2.4%
n_episode :1140, score : 316.5, n_buffer : 10000, eps : 2.3%
n_episode :1160, score : 328.1, n_buffer : 10000, eps : 2.2%
n_episode :1180, score : 333.8, n_buffer : 10000, eps : 2.1%
n_episode :1200, score : 254.6, n_buffer : 10000, eps : 2.0%
n_episode :1220, score : 250.2, n_buffer : 10000, eps : 1.9%
n_episode :1240, score : 262.2, n_buffer : 10000, eps : 1.8%
n_episode :1260, score : 347.8, n_buffer : 10000, eps : 1.7%
n_episode :1280, score : 217.1, n_buffer : 10000, eps : 1.6%
n_episode :1300, score : 145.2, n_buffer : 10000, eps : 1.5%
n_episode :1320, score : 151.9, n_buffer : 10000, eps : 1.4%
n_episode :1340, score : 136.8, n_buffer : 10000, eps : 1.3%
n_episode :1360, score : 237.9, n_buffer : 10000, eps : 1.2%
n_episode :1380, score : 297.6, n_buffer : 10000, eps : 1.1%
n_episode :1400, score : 254.8, n_buffer : 10000, eps : 1.0%
n_episode :1420, score : 331.9, n_buffer : 10000, eps : 1.0%
n_episode :1440, score : 262.1, n_buffer : 10000, eps : 1.0%
n_episode :1460, score : 256.2, n_buffer : 10000, eps : 1.0%
n_episode :1480, score : 301.1, n_buffer : 10000, eps : 1.0%
n_episode :1500, score : 255.8, n_buffer : 10000, eps : 1.0%
n_episode :1520, score : 353.5, n_buffer : 10000, eps : 1.0%
n_episode :1540, score : 225.1, n_buffer : 10000, eps : 1.0%
n_episode :1560, score : 211.3, n_buffer : 10000, eps : 1.0%
n_episode :1580, score : 273.2, n_buffer : 10000, eps : 1.0%
n_episode :1600, score : 213.2, n_buffer : 10000, eps : 1.0%
n_episode :1620, score : 228.7, n_buffer : 10000, eps : 1.0%
```

```
n_episode :1640, score : 337.3, n_buffer : 10000, eps : 1.0%
n_episode :1660, score : 373.7, n_buffer : 10000, eps : 1.0%
n_episode :1680, score : 282.6, n_buffer : 10000, eps : 1.0%
n_episode :1700, score : 271.4, n_buffer : 10000, eps : 1.0%
n_episode :1720, score : 251.6, n_buffer : 10000, eps : 1.0%
n_episode :1740, score : 293.9, n_buffer : 10000, eps : 1.0%
n_episode :1760, score : 210.7, n_buffer : 10000, eps : 1.0%
n_episode :1780, score : 148.9, n_buffer : 10000, eps : 1.0%
n_episode :1800, score : 137.7, n_buffer : 10000, eps : 1.0%
n_episode :1820, score : 228.8, n_buffer : 10000, eps : 1.0%
n_episode :1840, score : 325.2, n_buffer : 10000, eps : 1.0%
n_episode :1860, score : 449.6, n_buffer : 10000, eps : 1.0%
n_episode :1880, score : 352.1, n_buffer : 10000, eps : 1.0%
n_episode :1900, score : 303.4, n_buffer : 10000, eps : 1.0%
n_episode :1920, score : 302.7, n_buffer : 10000, eps : 1.0%
n_episode :1940, score : 436.6, n_buffer : 10000, eps : 1.0%
n_episode :1960, score : 349.6, n_buffer : 10000, eps : 1.0%
n_episode :1980, score : 245.8, n_buffer : 10000, eps : 1.0%
n_episode :2000, score : 137.5, n_buffer : 10000, eps : 1.0%
n_episode :2020, score : 176.4, n_buffer : 10000, eps : 1.0%
n_episode :2040, score : 264.1, n_buffer : 10000, eps : 1.0%
n_episode :2060, score : 247.5, n_buffer : 10000, eps : 1.0%
n_episode :2080, score : 348.1, n_buffer : 10000, eps : 1.0%
n_episode :2100, score : 268.4, n_buffer : 10000, eps : 1.0%
n_episode :2120, score : 138.7, n_buffer : 10000, eps : 1.0%
n_episode :2140, score : 199.4, n_buffer : 10000, eps : 1.0%
n_episode :2160, score : 157.9, n_buffer : 10000, eps : 1.0%
n_episode :2180, score : 309.4, n_buffer : 10000, eps : 1.0%
n_episode :2200, score : 231.4, n_buffer : 10000, eps : 1.0%
n_episode :2220, score : 264.7, n_buffer : 10000, eps : 1.0%
n_episode :2240, score : 378.4, n_buffer : 10000, eps : 1.0%
n_episode :2260, score : 235.7, n_buffer : 10000, eps : 1.0%
n_episode :2280, score : 377.1, n_buffer : 10000, eps : 1.0%
n_episode :2300, score : 412.6, n_buffer : 10000, eps : 1.0%
n_episode :2320, score : 396.9, n_buffer : 10000, eps : 1.0%
n_episode :2340, score : 364.1, n_buffer : 10000, eps : 1.0%
n_episode :2360, score : 354.8, n_buffer : 10000, eps : 1.0%
n_episode :2380, score : 446.6, n_buffer : 10000, eps : 1.0%
n_episode :2400, score : 405.1, n_buffer : 10000, eps : 1.0%
n_episode :2420, score : 238.0, n_buffer : 10000, eps : 1.0%
n_episode :2440, score : 275.4, n_buffer : 10000, eps : 1.0%
n_episode :2460, score : 218.3, n_buffer : 10000, eps : 1.0%
n_episode :2480, score : 232.1, n_buffer : 10000, eps : 1.0%
n_episode :2500, score : 213.7, n_buffer : 10000, eps : 1.0%
n_episode :2520, score : 282.4, n_buffer : 10000, eps : 1.0%
n_episode :2540, score : 338.6, n_buffer : 10000, eps : 1.0%
n_episode :2560, score : 441.4, n_buffer : 10000, eps : 1.0%
n_episode :2580, score : 297.6, n_buffer : 10000, eps : 1.0%
```

```
n_episode :2600, score : 263.8, n_buffer : 10000, eps : 1.0%
n_episode :2620, score : 425.4, n_buffer : 10000, eps : 1.0%
n_episode :2640, score : 369.8, n_buffer : 10000, eps : 1.0%
n_episode :2660, score : 381.8, n_buffer : 10000, eps : 1.0%
n_episode :2680, score : 231.1, n_buffer : 10000, eps : 1.0%
n_episode :2700, score : 427.2, n_buffer : 10000, eps : 1.0%
n_episode :2720, score : 291.4, n_buffer : 10000, eps : 1.0%
n_episode :2740, score : 335.1, n_buffer : 10000, eps : 1.0%
n_episode :2760, score : 283.9, n_buffer : 10000, eps : 1.0%
n_episode :2780, score : 476.1, n_buffer : 10000, eps : 1.0%
n_episode :2800, score : 344.1, n_buffer : 10000, eps : 1.0%
n_episode :2820, score : 363.2, n_buffer : 10000, eps : 1.0%
n_episode :2840, score : 428.9, n_buffer : 10000, eps : 1.0%
n_episode :2860, score : 389.8, n_buffer : 10000, eps : 1.0%
n_episode :2880, score : 352.4, n_buffer : 10000, eps : 1.0%
n_episode :2900, score : 252.5, n_buffer : 10000, eps : 1.0%
n_episode :2920, score : 324.7, n_buffer : 10000, eps : 1.0%
n_episode :2940, score : 196.4, n_buffer : 10000, eps : 1.0%
n_episode :2960, score : 318.9, n_buffer : 10000, eps : 1.0%
n_episode :2980, score : 352.4, n_buffer : 10000, eps : 1.0%
n_episode :3000, score : 343.0, n_buffer : 10000, eps : 1.0%
n_episode :3020, score : 274.4, n_buffer : 10000, eps : 1.0%
n_episode :3040, score : 351.7, n_buffer : 10000, eps : 1.0%
n_episode :3060, score : 296.6, n_buffer : 10000, eps : 1.0%
n_episode :3080, score : 300.7, n_buffer : 10000, eps : 1.0%
n_episode :3100, score : 401.6, n_buffer : 10000, eps : 1.0%
n_episode :3120, score : 342.4, n_buffer : 10000, eps : 1.0%
n_episode :3140, score : 401.2, n_buffer : 10000, eps : 1.0%
n_episode :3160, score : 309.6, n_buffer : 10000, eps : 1.0%
n_episode :3180, score : 261.9, n_buffer : 10000, eps : 1.0%
n_episode :3200, score : 431.1, n_buffer : 10000, eps : 1.0%
n_episode :3220, score : 314.3, n_buffer : 10000, eps : 1.0%
n_episode :3240, score : 353.6, n_buffer : 10000, eps : 1.0%
n_episode :3260, score : 406.8, n_buffer : 10000, eps : 1.0%
n_episode :3280, score : 272.9, n_buffer : 10000, eps : 1.0%
n_episode :3300, score : 347.5, n_buffer : 10000, eps : 1.0%
n_episode :3320, score : 352.4, n_buffer : 10000, eps : 1.0%
n_episode :3340, score : 264.5, n_buffer : 10000, eps : 1.0%
n_episode :3360, score : 315.2, n_buffer : 10000, eps : 1.0%
n_episode :3380, score : 240.4, n_buffer : 10000, eps : 1.0%
n_episode :3400, score : 208.4, n_buffer : 10000, eps : 1.0%
n_episode :3420, score : 190.1, n_buffer : 10000, eps : 1.0%
n_episode :3440, score : 183.2, n_buffer : 10000, eps : 1.0%
n_episode :3460, score : 202.9, n_buffer : 10000, eps : 1.0%
n_episode :3480, score : 178.9, n_buffer : 10000, eps : 1.0%
n_episode :3500, score : 189.4, n_buffer : 10000, eps : 1.0%
n_episode :3520, score : 196.2, n_buffer : 10000, eps : 1.0%
n_episode :3540, score : 178.8, n_buffer : 10000, eps : 1.0%
```

```
n_episode :3560, score : 191.3, n_buffer : 10000, eps : 1.0%
n_episode :3580, score : 190.1, n_buffer : 10000, eps : 1.0%
n_episode :3600, score : 196.5, n_buffer : 10000, eps : 1.0%
n_episode :3620, score : 195.7, n_buffer : 10000, eps : 1.0%
n_episode :3640, score : 222.1, n_buffer : 10000, eps : 1.0%
n_episode :3660, score : 249.2, n_buffer : 10000, eps : 1.0%
n_episode :3680, score : 399.4, n_buffer : 10000, eps : 1.0%
n_episode :3700, score : 395.0, n_buffer : 10000, eps : 1.0%
n_episode :3720, score : 300.0, n_buffer : 10000, eps : 1.0%
n_episode :3740, score : 350.2, n_buffer : 10000, eps : 1.0%
n_episode :3760, score : 213.4, n_buffer : 10000, eps : 1.0%
n_episode :3780, score : 304.2, n_buffer : 10000, eps : 1.0%
n_episode :3800, score : 238.7, n_buffer : 10000, eps : 1.0%
n_episode :3820, score : 321.0, n_buffer : 10000, eps : 1.0%
n_episode :3840, score : 203.2, n_buffer : 10000, eps : 1.0%
n_episode :3860, score : 306.8, n_buffer : 10000, eps : 1.0%
n_episode :3880, score : 319.1, n_buffer : 10000, eps : 1.0%
n_episode :3900, score : 380.6, n_buffer : 10000, eps : 1.0%
n_episode :3920, score : 483.1, n_buffer : 10000, eps : 1.0%
n_episode :3940, score : 458.6, n_buffer : 10000, eps : 1.0%
n_episode :3960, score : 337.4, n_buffer : 10000, eps : 1.0%
n_episode :3980, score : 443.0, n_buffer : 10000, eps : 1.0%
n_episode :4000, score : 333.8, n_buffer : 10000, eps : 1.0%
n_episode :4020, score : 379.1, n_buffer : 10000, eps : 1.0%
n_episode :4040, score : 283.1, n_buffer : 10000, eps : 1.0%
n_episode :4060, score : 297.9, n_buffer : 10000, eps : 1.0%
n_episode :4080, score : 284.8, n_buffer : 10000, eps : 1.0%
n_episode :4100, score : 263.3, n_buffer : 10000, eps : 1.0%
n_episode :4120, score : 260.1, n_buffer : 10000, eps : 1.0%
n_episode :4140, score : 194.9, n_buffer : 10000, eps : 1.0%
n_episode :4160, score : 215.2, n_buffer : 10000, eps : 1.0%
n_episode :4180, score : 262.4, n_buffer : 10000, eps : 1.0%
n_episode :4200, score : 303.4, n_buffer : 10000, eps : 1.0%
n_episode :4220, score : 326.9, n_buffer : 10000, eps : 1.0%
n_episode :4240, score : 454.2, n_buffer : 10000, eps : 1.0%
n_episode :4260, score : 424.0, n_buffer : 10000, eps : 1.0%
n_episode :4280, score : 321.6, n_buffer : 10000, eps : 1.0%
n_episode :4300, score : 281.1, n_buffer : 10000, eps : 1.0%
n_episode :4320, score : 453.2, n_buffer : 10000, eps : 1.0%
n_episode :4340, score : 299.5, n_buffer : 10000, eps : 1.0%
n_episode :4360, score : 427.1, n_buffer : 10000, eps : 1.0%
n_episode :4380, score : 342.4, n_buffer : 10000, eps : 1.0%
n_episode :4400, score : 286.3, n_buffer : 10000, eps : 1.0%
n_episode :4420, score : 162.8, n_buffer : 10000, eps : 1.0%
n_episode :4440, score : 354.9, n_buffer : 10000, eps : 1.0%
n_episode :4460, score : 430.8, n_buffer : 10000, eps : 1.0%
n_episode :4480, score : 375.3, n_buffer : 10000, eps : 1.0%
n_episode :4500, score : 359.2, n_buffer : 10000, eps : 1.0%
```

```
n_episode :4520, score : 296.8, n_buffer : 10000, eps : 1.0%
n_episode :4540, score : 187.8, n_buffer : 10000, eps : 1.0%
n_episode :4560, score : 206.9, n_buffer : 10000, eps : 1.0%
n_episode :4580, score : 201.2, n_buffer : 10000, eps : 1.0%
n_episode :4600, score : 225.1, n_buffer : 10000, eps : 1.0%
n_episode :4620, score : 224.3, n_buffer : 10000, eps : 1.0%
n_episode :4640, score : 274.4, n_buffer : 10000, eps : 1.0%
n_episode :4660, score : 336.2, n_buffer : 10000, eps : 1.0%
n_episode :4680, score : 314.1, n_buffer : 10000, eps : 1.0%
n_episode :4700, score : 327.4, n_buffer : 10000, eps : 1.0%
n_episode :4720, score : 299.9, n_buffer : 10000, eps : 1.0%
n_episode :4740, score : 253.2, n_buffer : 10000, eps : 1.0%
n_episode :4760, score : 333.4, n_buffer : 10000, eps : 1.0%
n_episode :4780, score : 412.2, n_buffer : 10000, eps : 1.0%
n_episode :4800, score : 332.1, n_buffer : 10000, eps : 1.0%
n_episode :4820, score : 314.0, n_buffer : 10000, eps : 1.0%
n_episode :4840, score : 390.9, n_buffer : 10000, eps : 1.0%
n_episode :4860, score : 280.4, n_buffer : 10000, eps : 1.0%
n_episode :4880, score : 348.7, n_buffer : 10000, eps : 1.0%
n_episode :4900, score : 310.9, n_buffer : 10000, eps : 1.0%
n_episode :4920, score : 373.5, n_buffer : 10000, eps : 1.0%
n_episode :4940, score : 346.4, n_buffer : 10000, eps : 1.0%
n_episode :4960, score : 413.4, n_buffer : 10000, eps : 1.0%
n_episode :4980, score : 427.1, n_buffer : 10000, eps : 1.0%
n_episode :5000, score : 411.9, n_buffer : 10000, eps : 1.0%
n_episode :5020, score : 467.6, n_buffer : 10000, eps : 1.0%
n_episode :5040, score : 384.8, n_buffer : 10000, eps : 1.0%
n_episode :5060, score : 367.1, n_buffer : 10000, eps : 1.0%
n_episode :5080, score : 448.4, n_buffer : 10000, eps : 1.0%
n_episode :5100, score : 444.4, n_buffer : 10000, eps : 1.0%
n_episode :5120, score : 172.2, n_buffer : 10000, eps : 1.0%
n_episode :5140, score : 121.8, n_buffer : 10000, eps : 1.0%
n_episode :5160, score : 10.3, n_buffer : 10000, eps : 1.0%
n_episode :5180, score : 11.1, n_buffer : 10000, eps : 1.0%
n_episode :5200, score : 381.0, n_buffer : 10000, eps : 1.0%
n_episode :5220, score : 195.1, n_buffer : 10000, eps : 1.0%
n_episode :5240, score : 138.3, n_buffer : 10000, eps : 1.0%
n_episode :5260, score : 145.6, n_buffer : 10000, eps : 1.0%
n_episode :5280, score : 123.5, n_buffer : 10000, eps : 1.0%
n_episode :5300, score : 176.9, n_buffer : 10000, eps : 1.0%
n_episode :5320, score : 164.6, n_buffer : 10000, eps : 1.0%
n_episode :5340, score : 167.1, n_buffer : 10000, eps : 1.0%
n_episode :5360, score : 149.7, n_buffer : 10000, eps : 1.0%
n_episode :5380, score : 223.3, n_buffer : 10000, eps : 1.0%
n_episode :5400, score : 161.0, n_buffer : 10000, eps : 1.0%
n_episode :5420, score : 267.8, n_buffer : 10000, eps : 1.0%
n_episode :5440, score : 192.3, n_buffer : 10000, eps : 1.0%
n_episode :5460, score : 449.2, n_buffer : 10000, eps : 1.0%
```

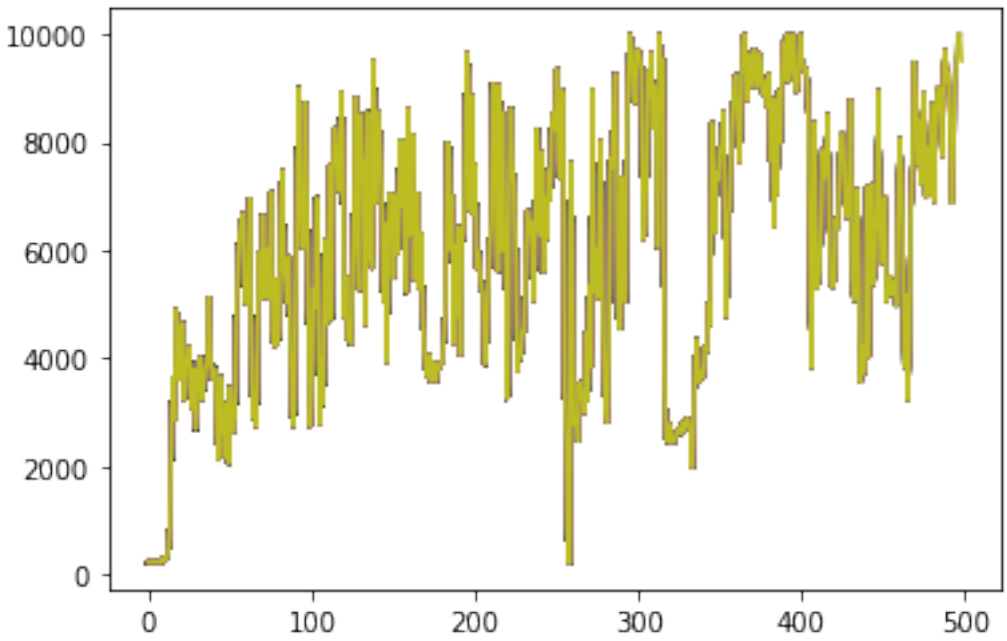
```
n_episode :5480, score : 261.7, n_buffer : 10000, eps : 1.0%
n_episode :5500, score : 301.1, n_buffer : 10000, eps : 1.0%
n_episode :5520, score : 255.5, n_buffer : 10000, eps : 1.0%
n_episode :5540, score : 285.0, n_buffer : 10000, eps : 1.0%
n_episode :5560, score : 401.2, n_buffer : 10000, eps : 1.0%
n_episode :5580, score : 262.1, n_buffer : 10000, eps : 1.0%
n_episode :5600, score : 199.7, n_buffer : 10000, eps : 1.0%
n_episode :5620, score : 150.8, n_buffer : 10000, eps : 1.0%
n_episode :5640, score : 140.7, n_buffer : 10000, eps : 1.0%
n_episode :5660, score : 222.8, n_buffer : 10000, eps : 1.0%
n_episode :5680, score : 384.8, n_buffer : 10000, eps : 1.0%
n_episode :5700, score : 376.9, n_buffer : 10000, eps : 1.0%
n_episode :5720, score : 430.6, n_buffer : 10000, eps : 1.0%
n_episode :5740, score : 462.9, n_buffer : 10000, eps : 1.0%
n_episode :5760, score : 324.4, n_buffer : 10000, eps : 1.0%
n_episode :5780, score : 228.1, n_buffer : 10000, eps : 1.0%
n_episode :5800, score : 227.4, n_buffer : 10000, eps : 1.0%
n_episode :5820, score : 367.4, n_buffer : 10000, eps : 1.0%
n_episode :5840, score : 301.1, n_buffer : 10000, eps : 1.0%
n_episode :5860, score : 252.6, n_buffer : 10000, eps : 1.0%
n_episode :5880, score : 413.2, n_buffer : 10000, eps : 1.0%
n_episode :5900, score : 466.4, n_buffer : 10000, eps : 1.0%
n_episode :5920, score : 500.0, n_buffer : 10000, eps : 1.0%
n_episode :5940, score : 485.2, n_buffer : 10000, eps : 1.0%
n_episode :5960, score : 443.7, n_buffer : 10000, eps : 1.0%
n_episode :5980, score : 436.4, n_buffer : 10000, eps : 1.0%
n_episode :6000, score : 484.1, n_buffer : 10000, eps : 1.0%
n_episode :6020, score : 486.1, n_buffer : 10000, eps : 1.0%
n_episode :6040, score : 476.5, n_buffer : 10000, eps : 1.0%
n_episode :6060, score : 467.4, n_buffer : 10000, eps : 1.0%
n_episode :6080, score : 310.1, n_buffer : 10000, eps : 1.0%
n_episode :6100, score : 318.6, n_buffer : 10000, eps : 1.0%
n_episode :6120, score : 359.3, n_buffer : 10000, eps : 1.0%
n_episode :6140, score : 466.1, n_buffer : 10000, eps : 1.0%
n_episode :6160, score : 444.0, n_buffer : 10000, eps : 1.0%
n_episode :6180, score : 482.8, n_buffer : 10000, eps : 1.0%
n_episode :6200, score : 413.2, n_buffer : 10000, eps : 1.0%
n_episode :6220, score : 451.7, n_buffer : 10000, eps : 1.0%
n_episode :6240, score : 418.3, n_buffer : 10000, eps : 1.0%
n_episode :6260, score : 303.2, n_buffer : 10000, eps : 1.0%
n_episode :6280, score : 500.0, n_buffer : 10000, eps : 1.0%
n_episode :6300, score : 463.6, n_buffer : 10000, eps : 1.0%
n_episode :6320, score : 476.6, n_buffer : 10000, eps : 1.0%
n_episode :6340, score : 184.8, n_buffer : 10000, eps : 1.0%
n_episode :6360, score : 127.4, n_buffer : 10000, eps : 1.0%
n_episode :6380, score : 123.2, n_buffer : 10000, eps : 1.0%
n_episode :6400, score : 138.8, n_buffer : 10000, eps : 1.0%
n_episode :6420, score : 121.8, n_buffer : 10000, eps : 1.0%
```

```
n_episode :6440, score : 125.5, n_buffer : 10000, eps : 1.0%
n_episode :6460, score : 123.2, n_buffer : 10000, eps : 1.0%
n_episode :6480, score : 130.2, n_buffer : 10000, eps : 1.0%
n_episode :6500, score : 132.1, n_buffer : 10000, eps : 1.0%
n_episode :6520, score : 135.1, n_buffer : 10000, eps : 1.0%
n_episode :6540, score : 130.4, n_buffer : 10000, eps : 1.0%
n_episode :6560, score : 140.3, n_buffer : 10000, eps : 1.0%
n_episode :6580, score : 132.7, n_buffer : 10000, eps : 1.0%
n_episode :6600, score : 136.0, n_buffer : 10000, eps : 1.0%
n_episode :6620, score : 144.2, n_buffer : 10000, eps : 1.0%
n_episode :6640, score : 137.8, n_buffer : 10000, eps : 1.0%
n_episode :6660, score : 135.5, n_buffer : 10000, eps : 1.0%
n_episode :6680, score : 99.1, n_buffer : 10000, eps : 1.0%
n_episode :6700, score : 150.3, n_buffer : 10000, eps : 1.0%
n_episode :6720, score : 195.2, n_buffer : 10000, eps : 1.0%
n_episode :6740, score : 216.8, n_buffer : 10000, eps : 1.0%
n_episode :6760, score : 178.1, n_buffer : 10000, eps : 1.0%
n_episode :6780, score : 187.6, n_buffer : 10000, eps : 1.0%
n_episode :6800, score : 182.2, n_buffer : 10000, eps : 1.0%
n_episode :6820, score : 185.6, n_buffer : 10000, eps : 1.0%
n_episode :6840, score : 211.3, n_buffer : 10000, eps : 1.0%
n_episode :6860, score : 207.0, n_buffer : 10000, eps : 1.0%
n_episode :6880, score : 250.2, n_buffer : 10000, eps : 1.0%
n_episode :6900, score : 230.5, n_buffer : 10000, eps : 1.0%
n_episode :6920, score : 417.4, n_buffer : 10000, eps : 1.0%
n_episode :6940, score : 343.1, n_buffer : 10000, eps : 1.0%
n_episode :6960, score : 316.7, n_buffer : 10000, eps : 1.0%
n_episode :6980, score : 371.5, n_buffer : 10000, eps : 1.0%
n_episode :7000, score : 365.3, n_buffer : 10000, eps : 1.0%
n_episode :7020, score : 394.6, n_buffer : 10000, eps : 1.0%
n_episode :7040, score : 392.4, n_buffer : 10000, eps : 1.0%
n_episode :7060, score : 428.6, n_buffer : 10000, eps : 1.0%
n_episode :7080, score : 351.3, n_buffer : 10000, eps : 1.0%
n_episode :7100, score : 238.9, n_buffer : 10000, eps : 1.0%
n_episode :7120, score : 335.1, n_buffer : 10000, eps : 1.0%
n_episode :7140, score : 337.4, n_buffer : 10000, eps : 1.0%
n_episode :7160, score : 404.2, n_buffer : 10000, eps : 1.0%
n_episode :7180, score : 432.9, n_buffer : 10000, eps : 1.0%
n_episode :7200, score : 458.8, n_buffer : 10000, eps : 1.0%
n_episode :7220, score : 462.0, n_buffer : 10000, eps : 1.0%
n_episode :7240, score : 413.6, n_buffer : 10000, eps : 1.0%
n_episode :7260, score : 381.4, n_buffer : 10000, eps : 1.0%
n_episode :7280, score : 440.4, n_buffer : 10000, eps : 1.0%
n_episode :7300, score : 492.1, n_buffer : 10000, eps : 1.0%
n_episode :7320, score : 500.0, n_buffer : 10000, eps : 1.0%
n_episode :7340, score : 475.7, n_buffer : 10000, eps : 1.0%
n_episode :7360, score : 438.8, n_buffer : 10000, eps : 1.0%
n_episode :7380, score : 480.9, n_buffer : 10000, eps : 1.0%
```

```
n_episode :7400, score : 451.9, n_buffer : 10000, eps : 1.0%
n_episode :7420, score : 475.7, n_buffer : 10000, eps : 1.0%
n_episode :7440, score : 485.9, n_buffer : 10000, eps : 1.0%
n_episode :7460, score : 451.9, n_buffer : 10000, eps : 1.0%
n_episode :7480, score : 451.8, n_buffer : 10000, eps : 1.0%
n_episode :7500, score : 482.6, n_buffer : 10000, eps : 1.0%
n_episode :7520, score : 475.9, n_buffer : 10000, eps : 1.0%
n_episode :7540, score : 447.1, n_buffer : 10000, eps : 1.0%
n_episode :7560, score : 443.9, n_buffer : 10000, eps : 1.0%
n_episode :7580, score : 456.4, n_buffer : 10000, eps : 1.0%
n_episode :7600, score : 432.9, n_buffer : 10000, eps : 1.0%
n_episode :7620, score : 463.6, n_buffer : 10000, eps : 1.0%
n_episode :7640, score : 383.9, n_buffer : 10000, eps : 1.0%
n_episode :7660, score : 440.0, n_buffer : 10000, eps : 1.0%
n_episode :7680, score : 321.8, n_buffer : 10000, eps : 1.0%
n_episode :7700, score : 438.9, n_buffer : 10000, eps : 1.0%
n_episode :7720, score : 351.8, n_buffer : 10000, eps : 1.0%
n_episode :7740, score : 447.5, n_buffer : 10000, eps : 1.0%
n_episode :7760, score : 399.7, n_buffer : 10000, eps : 1.0%
n_episode :7780, score : 461.4, n_buffer : 10000, eps : 1.0%
n_episode :7800, score : 492.3, n_buffer : 10000, eps : 1.0%
n_episode :7820, score : 458.8, n_buffer : 10000, eps : 1.0%
n_episode :7840, score : 500.0, n_buffer : 10000, eps : 1.0%
n_episode :7860, score : 456.8, n_buffer : 10000, eps : 1.0%
n_episode :7880, score : 464.5, n_buffer : 10000, eps : 1.0%
n_episode :7900, score : 476.1, n_buffer : 10000, eps : 1.0%
n_episode :7920, score : 500.0, n_buffer : 10000, eps : 1.0%
n_episode :7940, score : 454.1, n_buffer : 10000, eps : 1.0%
n_episode :7960, score : 447.4, n_buffer : 10000, eps : 1.0%
n_episode :7980, score : 458.9, n_buffer : 10000, eps : 1.0%
n_episode :8000, score : 500.0, n_buffer : 10000, eps : 1.0%
n_episode :8020, score : 475.8, n_buffer : 10000, eps : 1.0%
n_episode :8040, score : 471.8, n_buffer : 10000, eps : 1.0%
n_episode :8060, score : 465.0, n_buffer : 10000, eps : 1.0%
n_episode :8080, score : 467.7, n_buffer : 10000, eps : 1.0%
n_episode :8100, score : 436.8, n_buffer : 10000, eps : 1.0%
n_episode :8120, score : 306.1, n_buffer : 10000, eps : 1.0%
n_episode :8140, score : 191.4, n_buffer : 10000, eps : 1.0%
n_episode :8160, score : 332.0, n_buffer : 10000, eps : 1.0%
n_episode :8180, score : 418.2, n_buffer : 10000, eps : 1.0%
n_episode :8200, score : 264.8, n_buffer : 10000, eps : 1.0%
n_episode :8220, score : 270.4, n_buffer : 10000, eps : 1.0%
n_episode :8240, score : 282.9, n_buffer : 10000, eps : 1.0%
n_episode :8260, score : 330.6, n_buffer : 10000, eps : 1.0%
n_episode :8280, score : 392.6, n_buffer : 10000, eps : 1.0%
n_episode :8300, score : 367.3, n_buffer : 10000, eps : 1.0%
n_episode :8320, score : 382.0, n_buffer : 10000, eps : 1.0%
n_episode :8340, score : 425.6, n_buffer : 10000, eps : 1.0%
```

```
n_episode :8360, score : 326.4, n_buffer : 10000, eps : 1.0%
n_episode :8380, score : 269.4, n_buffer : 10000, eps : 1.0%
n_episode :8400, score : 265.9, n_buffer : 10000, eps : 1.0%
n_episode :8420, score : 273.7, n_buffer : 10000, eps : 1.0%
n_episode :8440, score : 328.6, n_buffer : 10000, eps : 1.0%
n_episode :8460, score : 321.4, n_buffer : 10000, eps : 1.0%
n_episode :8480, score : 356.2, n_buffer : 10000, eps : 1.0%
n_episode :8500, score : 406.1, n_buffer : 10000, eps : 1.0%
n_episode :8520, score : 407.7, n_buffer : 10000, eps : 1.0%
n_episode :8540, score : 384.6, n_buffer : 10000, eps : 1.0%
n_episode :8560, score : 340.6, n_buffer : 10000, eps : 1.0%
n_episode :8580, score : 330.6, n_buffer : 10000, eps : 1.0%
n_episode :8600, score : 355.8, n_buffer : 10000, eps : 1.0%
n_episode :8620, score : 438.7, n_buffer : 10000, eps : 1.0%
n_episode :8640, score : 278.4, n_buffer : 10000, eps : 1.0%
n_episode :8660, score : 254.1, n_buffer : 10000, eps : 1.0%
n_episode :8680, score : 302.4, n_buffer : 10000, eps : 1.0%
n_episode :8700, score : 356.6, n_buffer : 10000, eps : 1.0%
n_episode :8720, score : 285.5, n_buffer : 10000, eps : 1.0%
n_episode :8740, score : 178.1, n_buffer : 10000, eps : 1.0%
n_episode :8760, score : 211.7, n_buffer : 10000, eps : 1.0%
n_episode :8780, score : 186.3, n_buffer : 10000, eps : 1.0%
n_episode :8800, score : 203.1, n_buffer : 10000, eps : 1.0%
n_episode :8820, score : 358.7, n_buffer : 10000, eps : 1.0%
n_episode :8840, score : 201.2, n_buffer : 10000, eps : 1.0%
n_episode :8860, score : 344.9, n_buffer : 10000, eps : 1.0%
n_episode :8880, score : 360.7, n_buffer : 10000, eps : 1.0%
n_episode :8900, score : 268.9, n_buffer : 10000, eps : 1.0%
n_episode :8920, score : 291.7, n_buffer : 10000, eps : 1.0%
n_episode :8940, score : 339.9, n_buffer : 10000, eps : 1.0%
n_episode :8960, score : 447.2, n_buffer : 10000, eps : 1.0%
n_episode :8980, score : 323.8, n_buffer : 10000, eps : 1.0%
n_episode :9000, score : 289.1, n_buffer : 10000, eps : 1.0%
n_episode :9020, score : 294.5, n_buffer : 10000, eps : 1.0%
n_episode :9040, score : 349.1, n_buffer : 10000, eps : 1.0%
n_episode :9060, score : 252.3, n_buffer : 10000, eps : 1.0%
n_episode :9080, score : 265.9, n_buffer : 10000, eps : 1.0%
n_episode :9100, score : 275.4, n_buffer : 10000, eps : 1.0%
n_episode :9120, score : 259.3, n_buffer : 10000, eps : 1.0%
n_episode :9140, score : 262.1, n_buffer : 10000, eps : 1.0%
n_episode :9160, score : 271.2, n_buffer : 10000, eps : 1.0%
n_episode :9180, score : 249.5, n_buffer : 10000, eps : 1.0%
n_episode :9200, score : 321.6, n_buffer : 10000, eps : 1.0%
n_episode :9220, score : 403.1, n_buffer : 10000, eps : 1.0%
n_episode :9240, score : 374.4, n_buffer : 10000, eps : 1.0%
n_episode :9260, score : 313.9, n_buffer : 10000, eps : 1.0%
n_episode :9280, score : 192.2, n_buffer : 10000, eps : 1.0%
n_episode :9300, score : 258.9, n_buffer : 10000, eps : 1.0%
```

```
n_episode :9320, score : 161.4, n_buffer : 10000, eps : 1.0%
n_episode :9340, score : 217.0, n_buffer : 10000, eps : 1.0%
n_episode :9360, score : 337.8, n_buffer : 10000, eps : 1.0%
n_episode :9380, score : 384.3, n_buffer : 10000, eps : 1.0%
n_episode :9400, score : 474.2, n_buffer : 10000, eps : 1.0%
n_episode :9420, score : 443.0, n_buffer : 10000, eps : 1.0%
n_episode :9440, score : 380.2, n_buffer : 10000, eps : 1.0%
n_episode :9460, score : 420.4, n_buffer : 10000, eps : 1.0%
n_episode :9480, score : 361.4, n_buffer : 10000, eps : 1.0%
n_episode :9500, score : 420.1, n_buffer : 10000, eps : 1.0%
n_episode :9520, score : 444.8, n_buffer : 10000, eps : 1.0%
n_episode :9540, score : 350.7, n_buffer : 10000, eps : 1.0%
n_episode :9560, score : 395.6, n_buffer : 10000, eps : 1.0%
n_episode :9580, score : 351.4, n_buffer : 10000, eps : 1.0%
n_episode :9600, score : 393.2, n_buffer : 10000, eps : 1.0%
n_episode :9620, score : 435.6, n_buffer : 10000, eps : 1.0%
n_episode :9640, score : 345.5, n_buffer : 10000, eps : 1.0%
n_episode :9660, score : 418.6, n_buffer : 10000, eps : 1.0%
n_episode :9680, score : 445.5, n_buffer : 10000, eps : 1.0%
n_episode :9700, score : 451.2, n_buffer : 10000, eps : 1.0%
n_episode :9720, score : 426.9, n_buffer : 10000, eps : 1.0%
n_episode :9740, score : 387.4, n_buffer : 10000, eps : 1.0%
n_episode :9760, score : 469.7, n_buffer : 10000, eps : 1.0%
n_episode :9780, score : 485.4, n_buffer : 10000, eps : 1.0%
n_episode :9800, score : 456.2, n_buffer : 10000, eps : 1.0%
n_episode :9820, score : 464.9, n_buffer : 10000, eps : 1.0%
n_episode :9840, score : 415.6, n_buffer : 10000, eps : 1.0%
n_episode :9860, score : 344.1, n_buffer : 10000, eps : 1.0%
n_episode :9880, score : 388.8, n_buffer : 10000, eps : 1.0%
n_episode :9900, score : 454.9, n_buffer : 10000, eps : 1.0%
n_episode :9920, score : 479.2, n_buffer : 10000, eps : 1.0%
n_episode :9940, score : 500.0, n_buffer : 10000, eps : 1.0%
n_episode :9960, score : 500.0, n_buffer : 10000, eps : 1.0%
n_episode :9980, score : 475.4, n_buffer : 10000, eps : 1.0%
```



when we change the buffer limit value from 50000 to 10000, we can see that the scores are smaller.

[15]:
```
#BUFFER LIMIT changed to from 50000 to 25000

#Hyperparameters
learning_rate = 0.0005
gamma         = 0.98
buffer_limit  = 25000
batch_size    = 32

if __name__ == '__main__':
    main()
    plt.show()
```

```
n_episode :20, score : 9.9, n_buffer : 199, eps : 7.9%
n_episode :40, score : 10.0, n_buffer : 399, eps : 7.8%
n_episode :60, score : 9.8, n_buffer : 595, eps : 7.7%
n_episode :80, score : 10.2, n_buffer : 800, eps : 7.6%
n_episode :100, score : 9.6, n_buffer : 991, eps : 7.5%
n_episode :120, score : 9.6, n_buffer : 1183, eps : 7.4%
n_episode :140, score : 10.0, n_buffer : 1383, eps : 7.3%
n_episode :160, score : 10.2, n_buffer : 1588, eps : 7.2%
n_episode :180, score : 10.1, n_buffer : 1790, eps : 7.1%
n_episode :200, score : 9.7, n_buffer : 1983, eps : 7.0%
n_episode :220, score : 16.1, n_buffer : 2305, eps : 6.9%
n_episode :240, score : 17.6, n_buffer : 2656, eps : 6.8%
```

```
n_episode :260, score : 26.9, n_buffer : 3195, eps : 6.7%
n_episode :280, score : 44.1, n_buffer : 4078, eps : 6.6%
n_episode :300, score : 81.3, n_buffer : 5705, eps : 6.5%
n_episode :320, score : 112.0, n_buffer : 7945, eps : 6.4%
n_episode :340, score : 186.2, n_buffer : 11668, eps : 6.3%
n_episode :360, score : 84.7, n_buffer : 13362, eps : 6.2%
n_episode :380, score : 175.9, n_buffer : 16881, eps : 6.1%
n_episode :400, score : 142.5, n_buffer : 19731, eps : 6.0%
n_episode :420, score : 81.8, n_buffer : 21368, eps : 5.9%
n_episode :440, score : 88.3, n_buffer : 23134, eps : 5.8%
n_episode :460, score : 76.5, n_buffer : 24665, eps : 5.7%
n_episode :480, score : 167.1, n_buffer : 25000, eps : 5.6%
n_episode :500, score : 301.0, n_buffer : 25000, eps : 5.5%
n_episode :520, score : 291.8, n_buffer : 25000, eps : 5.4%
n_episode :540, score : 248.0, n_buffer : 25000, eps : 5.3%
n_episode :560, score : 179.9, n_buffer : 25000, eps : 5.2%
n_episode :580, score : 238.3, n_buffer : 25000, eps : 5.1%
n_episode :600, score : 272.1, n_buffer : 25000, eps : 5.0%
n_episode :620, score : 256.1, n_buffer : 25000, eps : 4.9%
n_episode :640, score : 323.2, n_buffer : 25000, eps : 4.8%
n_episode :660, score : 411.4, n_buffer : 25000, eps : 4.7%
n_episode :680, score : 299.8, n_buffer : 25000, eps : 4.6%
n_episode :700, score : 360.4, n_buffer : 25000, eps : 4.5%
n_episode :720, score : 413.4, n_buffer : 25000, eps : 4.4%
n_episode :740, score : 446.4, n_buffer : 25000, eps : 4.3%
n_episode :760, score : 396.8, n_buffer : 25000, eps : 4.2%
n_episode :780, score : 370.4, n_buffer : 25000, eps : 4.1%
n_episode :800, score : 355.2, n_buffer : 25000, eps : 4.0%
n_episode :820, score : 450.4, n_buffer : 25000, eps : 3.9%
n_episode :840, score : 348.4, n_buffer : 25000, eps : 3.8%
n_episode :860, score : 407.9, n_buffer : 25000, eps : 3.7%
n_episode :880, score : 385.2, n_buffer : 25000, eps : 3.6%
n_episode :900, score : 398.8, n_buffer : 25000, eps : 3.5%
n_episode :920, score : 392.6, n_buffer : 25000, eps : 3.4%
n_episode :940, score : 394.6, n_buffer : 25000, eps : 3.3%
n_episode :960, score : 330.6, n_buffer : 25000, eps : 3.2%
n_episode :980, score : 327.6, n_buffer : 25000, eps : 3.1%
n_episode :1000, score : 326.2, n_buffer : 25000, eps : 3.0%
n_episode :1020, score : 279.9, n_buffer : 25000, eps : 2.9%
n_episode :1040, score : 309.6, n_buffer : 25000, eps : 2.8%
n_episode :1060, score : 253.1, n_buffer : 25000, eps : 2.7%
n_episode :1080, score : 263.9, n_buffer : 25000, eps : 2.6%
n_episode :1100, score : 236.6, n_buffer : 25000, eps : 2.5%
n_episode :1120, score : 216.2, n_buffer : 25000, eps : 2.4%
n_episode :1140, score : 264.4, n_buffer : 25000, eps : 2.3%
n_episode :1160, score : 205.8, n_buffer : 25000, eps : 2.2%
n_episode :1180, score : 180.7, n_buffer : 25000, eps : 2.1%
n_episode :1200, score : 173.9, n_buffer : 25000, eps : 2.0%
```

```
n_episode :1220, score : 252.6, n_buffer : 25000, eps : 1.9%
n_episode :1240, score : 142.8, n_buffer : 25000, eps : 1.8%
n_episode :1260, score : 172.8, n_buffer : 25000, eps : 1.7%
n_episode :1280, score : 158.5, n_buffer : 25000, eps : 1.6%
n_episode :1300, score : 239.6, n_buffer : 25000, eps : 1.5%
n_episode :1320, score : 223.8, n_buffer : 25000, eps : 1.4%
n_episode :1340, score : 179.9, n_buffer : 25000, eps : 1.3%
n_episode :1360, score : 278.1, n_buffer : 25000, eps : 1.2%
n_episode :1380, score : 292.9, n_buffer : 25000, eps : 1.1%
n_episode :1400, score : 318.1, n_buffer : 25000, eps : 1.0%
n_episode :1420, score : 214.2, n_buffer : 25000, eps : 1.0%
n_episode :1440, score : 239.3, n_buffer : 25000, eps : 1.0%
n_episode :1460, score : 146.8, n_buffer : 25000, eps : 1.0%
n_episode :1480, score : 233.3, n_buffer : 25000, eps : 1.0%
n_episode :1500, score : 90.8, n_buffer : 25000, eps : 1.0%
n_episode :1520, score : 165.7, n_buffer : 25000, eps : 1.0%
n_episode :1540, score : 230.7, n_buffer : 25000, eps : 1.0%
n_episode :1560, score : 187.6, n_buffer : 25000, eps : 1.0%
n_episode :1580, score : 234.1, n_buffer : 25000, eps : 1.0%
n_episode :1600, score : 134.0, n_buffer : 25000, eps : 1.0%
n_episode :1620, score : 109.8, n_buffer : 25000, eps : 1.0%
n_episode :1640, score : 103.5, n_buffer : 25000, eps : 1.0%
n_episode :1660, score : 87.9, n_buffer : 25000, eps : 1.0%
n_episode :1680, score : 74.2, n_buffer : 25000, eps : 1.0%
n_episode :1700, score : 116.9, n_buffer : 25000, eps : 1.0%
n_episode :1720, score : 243.3, n_buffer : 25000, eps : 1.0%
n_episode :1740, score : 259.2, n_buffer : 25000, eps : 1.0%
n_episode :1760, score : 266.8, n_buffer : 25000, eps : 1.0%
n_episode :1780, score : 224.2, n_buffer : 25000, eps : 1.0%
n_episode :1800, score : 268.4, n_buffer : 25000, eps : 1.0%
n_episode :1820, score : 223.1, n_buffer : 25000, eps : 1.0%
n_episode :1840, score : 197.2, n_buffer : 25000, eps : 1.0%
n_episode :1860, score : 216.5, n_buffer : 25000, eps : 1.0%
n_episode :1880, score : 195.2, n_buffer : 25000, eps : 1.0%
n_episode :1900, score : 184.9, n_buffer : 25000, eps : 1.0%
n_episode :1920, score : 179.1, n_buffer : 25000, eps : 1.0%
n_episode :1940, score : 180.0, n_buffer : 25000, eps : 1.0%
n_episode :1960, score : 162.8, n_buffer : 25000, eps : 1.0%
n_episode :1980, score : 172.9, n_buffer : 25000, eps : 1.0%
n_episode :2000, score : 175.8, n_buffer : 25000, eps : 1.0%
n_episode :2020, score : 169.4, n_buffer : 25000, eps : 1.0%
n_episode :2040, score : 170.3, n_buffer : 25000, eps : 1.0%
n_episode :2060, score : 172.5, n_buffer : 25000, eps : 1.0%
n_episode :2080, score : 177.2, n_buffer : 25000, eps : 1.0%
n_episode :2100, score : 171.3, n_buffer : 25000, eps : 1.0%
n_episode :2120, score : 184.0, n_buffer : 25000, eps : 1.0%
n_episode :2140, score : 160.2, n_buffer : 25000, eps : 1.0%
n_episode :2160, score : 186.3, n_buffer : 25000, eps : 1.0%
```

```
n_episode :2180, score : 170.9, n_buffer : 25000, eps : 1.0%
n_episode :2200, score : 176.4, n_buffer : 25000, eps : 1.0%
n_episode :2220, score : 160.5, n_buffer : 25000, eps : 1.0%
n_episode :2240, score : 183.2, n_buffer : 25000, eps : 1.0%
n_episode :2260, score : 166.1, n_buffer : 25000, eps : 1.0%
n_episode :2280, score : 169.7, n_buffer : 25000, eps : 1.0%
n_episode :2300, score : 171.4, n_buffer : 25000, eps : 1.0%
n_episode :2320, score : 160.2, n_buffer : 25000, eps : 1.0%
n_episode :2340, score : 172.2, n_buffer : 25000, eps : 1.0%
n_episode :2360, score : 165.7, n_buffer : 25000, eps : 1.0%
n_episode :2380, score : 180.2, n_buffer : 25000, eps : 1.0%
n_episode :2400, score : 177.8, n_buffer : 25000, eps : 1.0%
n_episode :2420, score : 211.7, n_buffer : 25000, eps : 1.0%
n_episode :2440, score : 164.4, n_buffer : 25000, eps : 1.0%
n_episode :2460, score : 176.8, n_buffer : 25000, eps : 1.0%
n_episode :2480, score : 189.0, n_buffer : 25000, eps : 1.0%
n_episode :2500, score : 189.1, n_buffer : 25000, eps : 1.0%
n_episode :2520, score : 202.8, n_buffer : 25000, eps : 1.0%
n_episode :2540, score : 230.1, n_buffer : 25000, eps : 1.0%
n_episode :2560, score : 190.3, n_buffer : 25000, eps : 1.0%
n_episode :2580, score : 205.8, n_buffer : 25000, eps : 1.0%
n_episode :2600, score : 207.2, n_buffer : 25000, eps : 1.0%
n_episode :2620, score : 219.4, n_buffer : 25000, eps : 1.0%
n_episode :2640, score : 191.3, n_buffer : 25000, eps : 1.0%
n_episode :2660, score : 217.6, n_buffer : 25000, eps : 1.0%
n_episode :2680, score : 230.8, n_buffer : 25000, eps : 1.0%
n_episode :2700, score : 181.3, n_buffer : 25000, eps : 1.0%
n_episode :2720, score : 190.7, n_buffer : 25000, eps : 1.0%
n_episode :2740, score : 196.4, n_buffer : 25000, eps : 1.0%
n_episode :2760, score : 215.2, n_buffer : 25000, eps : 1.0%
n_episode :2780, score : 174.2, n_buffer : 25000, eps : 1.0%
n_episode :2800, score : 208.9, n_buffer : 25000, eps : 1.0%
n_episode :2820, score : 218.3, n_buffer : 25000, eps : 1.0%
n_episode :2840, score : 258.9, n_buffer : 25000, eps : 1.0%
n_episode :2860, score : 243.1, n_buffer : 25000, eps : 1.0%
n_episode :2880, score : 268.6, n_buffer : 25000, eps : 1.0%
n_episode :2900, score : 270.8, n_buffer : 25000, eps : 1.0%
n_episode :2920, score : 258.4, n_buffer : 25000, eps : 1.0%
n_episode :2940, score : 286.8, n_buffer : 25000, eps : 1.0%
n_episode :2960, score : 311.6, n_buffer : 25000, eps : 1.0%
n_episode :2980, score : 346.1, n_buffer : 25000, eps : 1.0%
n_episode :3000, score : 387.6, n_buffer : 25000, eps : 1.0%
n_episode :3020, score : 317.0, n_buffer : 25000, eps : 1.0%
n_episode :3040, score : 400.1, n_buffer : 25000, eps : 1.0%
n_episode :3060, score : 188.7, n_buffer : 25000, eps : 1.0%
n_episode :3080, score : 202.4, n_buffer : 25000, eps : 1.0%
n_episode :3100, score : 183.7, n_buffer : 25000, eps : 1.0%
n_episode :3120, score : 337.6, n_buffer : 25000, eps : 1.0%
```

```
n_episode :3140, score : 421.1, n_buffer : 25000, eps : 1.0%
n_episode :3160, score : 357.1, n_buffer : 25000, eps : 1.0%
n_episode :3180, score : 361.2, n_buffer : 25000, eps : 1.0%
n_episode :3200, score : 328.9, n_buffer : 25000, eps : 1.0%
n_episode :3220, score : 306.4, n_buffer : 25000, eps : 1.0%
n_episode :3240, score : 351.9, n_buffer : 25000, eps : 1.0%
n_episode :3260, score : 250.5, n_buffer : 25000, eps : 1.0%
n_episode :3280, score : 313.8, n_buffer : 25000, eps : 1.0%
n_episode :3300, score : 331.6, n_buffer : 25000, eps : 1.0%
n_episode :3320, score : 419.7, n_buffer : 25000, eps : 1.0%
n_episode :3340, score : 436.8, n_buffer : 25000, eps : 1.0%
n_episode :3360, score : 373.9, n_buffer : 25000, eps : 1.0%
n_episode :3380, score : 401.6, n_buffer : 25000, eps : 1.0%
n_episode :3400, score : 461.7, n_buffer : 25000, eps : 1.0%
n_episode :3420, score : 426.1, n_buffer : 25000, eps : 1.0%
n_episode :3440, score : 404.8, n_buffer : 25000, eps : 1.0%
n_episode :3460, score : 442.2, n_buffer : 25000, eps : 1.0%
n_episode :3480, score : 335.1, n_buffer : 25000, eps : 1.0%
n_episode :3500, score : 263.1, n_buffer : 25000, eps : 1.0%
n_episode :3520, score : 385.8, n_buffer : 25000, eps : 1.0%
n_episode :3540, score : 476.3, n_buffer : 25000, eps : 1.0%
n_episode :3560, score : 420.5, n_buffer : 25000, eps : 1.0%
n_episode :3580, score : 268.9, n_buffer : 25000, eps : 1.0%
n_episode :3600, score : 362.1, n_buffer : 25000, eps : 1.0%
n_episode :3620, score : 462.8, n_buffer : 25000, eps : 1.0%
n_episode :3640, score : 251.4, n_buffer : 25000, eps : 1.0%
n_episode :3660, score : 377.8, n_buffer : 25000, eps : 1.0%
n_episode :3680, score : 395.6, n_buffer : 25000, eps : 1.0%
n_episode :3700, score : 396.6, n_buffer : 25000, eps : 1.0%
n_episode :3720, score : 232.8, n_buffer : 25000, eps : 1.0%
n_episode :3740, score : 293.2, n_buffer : 25000, eps : 1.0%
n_episode :3760, score : 377.9, n_buffer : 25000, eps : 1.0%
n_episode :3780, score : 208.9, n_buffer : 25000, eps : 1.0%
n_episode :3800, score : 264.1, n_buffer : 25000, eps : 1.0%
n_episode :3820, score : 384.9, n_buffer : 25000, eps : 1.0%
n_episode :3840, score : 340.1, n_buffer : 25000, eps : 1.0%
n_episode :3860, score : 390.7, n_buffer : 25000, eps : 1.0%
n_episode :3880, score : 319.2, n_buffer : 25000, eps : 1.0%
n_episode :3900, score : 336.7, n_buffer : 25000, eps : 1.0%
n_episode :3920, score : 424.8, n_buffer : 25000, eps : 1.0%
n_episode :3940, score : 405.9, n_buffer : 25000, eps : 1.0%
n_episode :3960, score : 305.8, n_buffer : 25000, eps : 1.0%
n_episode :3980, score : 232.4, n_buffer : 25000, eps : 1.0%
n_episode :4000, score : 322.7, n_buffer : 25000, eps : 1.0%
n_episode :4020, score : 359.1, n_buffer : 25000, eps : 1.0%
n_episode :4040, score : 480.4, n_buffer : 25000, eps : 1.0%
n_episode :4060, score : 348.3, n_buffer : 25000, eps : 1.0%
n_episode :4080, score : 188.8, n_buffer : 25000, eps : 1.0%
```

```
n_episode :4100, score : 205.6, n_buffer : 25000, eps : 1.0%
n_episode :4120, score : 103.0, n_buffer : 25000, eps : 1.0%
n_episode :4140, score : 141.1, n_buffer : 25000, eps : 1.0%
n_episode :4160, score : 408.8, n_buffer : 25000, eps : 1.0%
n_episode :4180, score : 433.7, n_buffer : 25000, eps : 1.0%
n_episode :4200, score : 361.5, n_buffer : 25000, eps : 1.0%
n_episode :4220, score : 446.9, n_buffer : 25000, eps : 1.0%
n_episode :4240, score : 377.1, n_buffer : 25000, eps : 1.0%
n_episode :4260, score : 405.6, n_buffer : 25000, eps : 1.0%
n_episode :4280, score : 348.9, n_buffer : 25000, eps : 1.0%
n_episode :4300, score : 364.8, n_buffer : 25000, eps : 1.0%
n_episode :4320, score : 384.4, n_buffer : 25000, eps : 1.0%
n_episode :4340, score : 367.4, n_buffer : 25000, eps : 1.0%
n_episode :4360, score : 339.9, n_buffer : 25000, eps : 1.0%
n_episode :4380, score : 227.7, n_buffer : 25000, eps : 1.0%
n_episode :4400, score : 277.4, n_buffer : 25000, eps : 1.0%
n_episode :4420, score : 355.2, n_buffer : 25000, eps : 1.0%
n_episode :4440, score : 443.8, n_buffer : 25000, eps : 1.0%
n_episode :4460, score : 353.0, n_buffer : 25000, eps : 1.0%
n_episode :4480, score : 404.9, n_buffer : 25000, eps : 1.0%
n_episode :4500, score : 360.0, n_buffer : 25000, eps : 1.0%
n_episode :4520, score : 371.5, n_buffer : 25000, eps : 1.0%
n_episode :4540, score : 271.4, n_buffer : 25000, eps : 1.0%
n_episode :4560, score : 380.3, n_buffer : 25000, eps : 1.0%
n_episode :4580, score : 428.4, n_buffer : 25000, eps : 1.0%
n_episode :4600, score : 375.3, n_buffer : 25000, eps : 1.0%
n_episode :4620, score : 432.2, n_buffer : 25000, eps : 1.0%
n_episode :4640, score : 406.4, n_buffer : 25000, eps : 1.0%
n_episode :4660, score : 320.9, n_buffer : 25000, eps : 1.0%
n_episode :4680, score : 329.6, n_buffer : 25000, eps : 1.0%
n_episode :4700, score : 376.4, n_buffer : 25000, eps : 1.0%
n_episode :4720, score : 363.6, n_buffer : 25000, eps : 1.0%
n_episode :4740, score : 384.1, n_buffer : 25000, eps : 1.0%
n_episode :4760, score : 422.1, n_buffer : 25000, eps : 1.0%
n_episode :4780, score : 372.1, n_buffer : 25000, eps : 1.0%
n_episode :4800, score : 287.9, n_buffer : 25000, eps : 1.0%
n_episode :4820, score : 420.9, n_buffer : 25000, eps : 1.0%
n_episode :4840, score : 352.1, n_buffer : 25000, eps : 1.0%
n_episode :4860, score : 424.6, n_buffer : 25000, eps : 1.0%
n_episode :4880, score : 313.9, n_buffer : 25000, eps : 1.0%
n_episode :4900, score : 333.6, n_buffer : 25000, eps : 1.0%
n_episode :4920, score : 390.1, n_buffer : 25000, eps : 1.0%
n_episode :4940, score : 238.8, n_buffer : 25000, eps : 1.0%
n_episode :4960, score : 345.6, n_buffer : 25000, eps : 1.0%
n_episode :4980, score : 324.1, n_buffer : 25000, eps : 1.0%
n_episode :5000, score : 230.1, n_buffer : 25000, eps : 1.0%
n_episode :5020, score : 205.9, n_buffer : 25000, eps : 1.0%
n_episode :5040, score : 273.4, n_buffer : 25000, eps : 1.0%
```

```
n_episode :5060, score : 329.2, n_buffer : 25000, eps : 1.0%
n_episode :5080, score : 360.2, n_buffer : 25000, eps : 1.0%
n_episode :5100, score : 393.4, n_buffer : 25000, eps : 1.0%
n_episode :5120, score : 340.8, n_buffer : 25000, eps : 1.0%
n_episode :5140, score : 307.9, n_buffer : 25000, eps : 1.0%
n_episode :5160, score : 356.1, n_buffer : 25000, eps : 1.0%
n_episode :5180, score : 333.2, n_buffer : 25000, eps : 1.0%
n_episode :5200, score : 316.9, n_buffer : 25000, eps : 1.0%
n_episode :5220, score : 377.9, n_buffer : 25000, eps : 1.0%
n_episode :5240, score : 232.3, n_buffer : 25000, eps : 1.0%
n_episode :5260, score : 164.9, n_buffer : 25000, eps : 1.0%
n_episode :5280, score : 208.9, n_buffer : 25000, eps : 1.0%
n_episode :5300, score : 290.7, n_buffer : 25000, eps : 1.0%
n_episode :5320, score : 275.9, n_buffer : 25000, eps : 1.0%
n_episode :5340, score : 379.7, n_buffer : 25000, eps : 1.0%
n_episode :5360, score : 238.7, n_buffer : 25000, eps : 1.0%
n_episode :5380, score : 243.2, n_buffer : 25000, eps : 1.0%
n_episode :5400, score : 407.4, n_buffer : 25000, eps : 1.0%
n_episode :5420, score : 412.4, n_buffer : 25000, eps : 1.0%
n_episode :5440, score : 468.4, n_buffer : 25000, eps : 1.0%
n_episode :5460, score : 463.1, n_buffer : 25000, eps : 1.0%
n_episode :5480, score : 315.7, n_buffer : 25000, eps : 1.0%
n_episode :5500, score : 366.2, n_buffer : 25000, eps : 1.0%
n_episode :5520, score : 363.9, n_buffer : 25000, eps : 1.0%
n_episode :5540, score : 421.2, n_buffer : 25000, eps : 1.0%
n_episode :5560, score : 392.0, n_buffer : 25000, eps : 1.0%
n_episode :5580, score : 406.6, n_buffer : 25000, eps : 1.0%
n_episode :5600, score : 375.1, n_buffer : 25000, eps : 1.0%
n_episode :5620, score : 295.9, n_buffer : 25000, eps : 1.0%
n_episode :5640, score : 170.0, n_buffer : 25000, eps : 1.0%
n_episode :5660, score : 409.4, n_buffer : 25000, eps : 1.0%
n_episode :5680, score : 428.2, n_buffer : 25000, eps : 1.0%
n_episode :5700, score : 442.6, n_buffer : 25000, eps : 1.0%
n_episode :5720, score : 448.1, n_buffer : 25000, eps : 1.0%
n_episode :5740, score : 420.9, n_buffer : 25000, eps : 1.0%
n_episode :5760, score : 477.5, n_buffer : 25000, eps : 1.0%
n_episode :5780, score : 462.4, n_buffer : 25000, eps : 1.0%
n_episode :5800, score : 457.1, n_buffer : 25000, eps : 1.0%
n_episode :5820, score : 497.7, n_buffer : 25000, eps : 1.0%
n_episode :5840, score : 484.1, n_buffer : 25000, eps : 1.0%
n_episode :5860, score : 437.1, n_buffer : 25000, eps : 1.0%
n_episode :5880, score : 471.4, n_buffer : 25000, eps : 1.0%
n_episode :5900, score : 483.3, n_buffer : 25000, eps : 1.0%
n_episode :5920, score : 473.4, n_buffer : 25000, eps : 1.0%
n_episode :5940, score : 400.5, n_buffer : 25000, eps : 1.0%
n_episode :5960, score : 339.3, n_buffer : 25000, eps : 1.0%
n_episode :5980, score : 238.4, n_buffer : 25000, eps : 1.0%
n_episode :6000, score : 387.4, n_buffer : 25000, eps : 1.0%
```

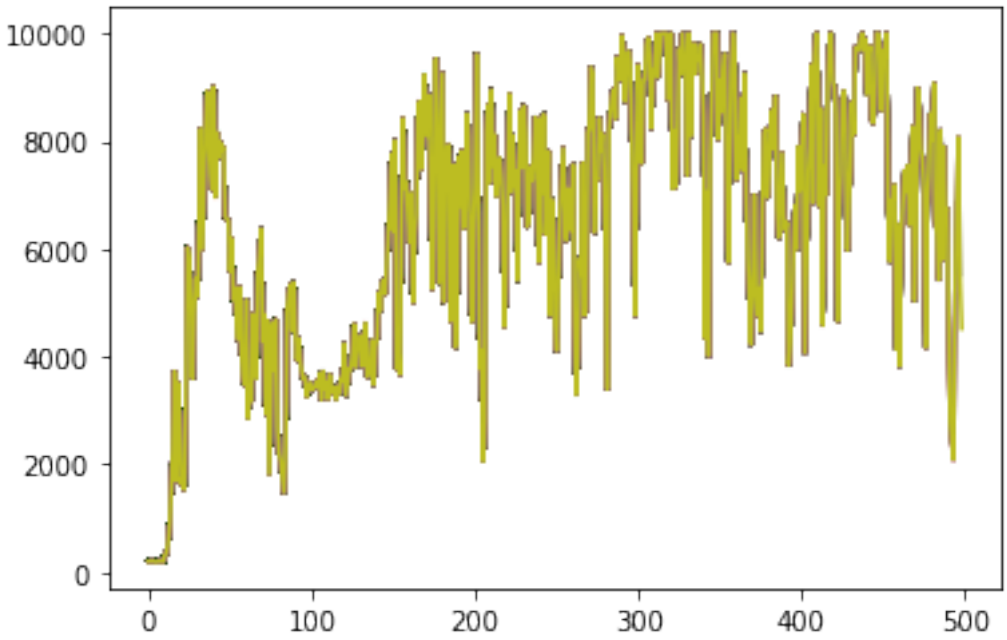
```
n_episode :6020, score : 470.5, n_buffer : 25000, eps : 1.0%
n_episode :6040, score : 436.4, n_buffer : 25000, eps : 1.0%
n_episode :6060, score : 379.6, n_buffer : 25000, eps : 1.0%
n_episode :6080, score : 456.4, n_buffer : 25000, eps : 1.0%
n_episode :6100, score : 457.1, n_buffer : 25000, eps : 1.0%
n_episode :6120, score : 488.9, n_buffer : 25000, eps : 1.0%
n_episode :6140, score : 495.9, n_buffer : 25000, eps : 1.0%
n_episode :6160, score : 478.6, n_buffer : 25000, eps : 1.0%
n_episode :6180, score : 412.4, n_buffer : 25000, eps : 1.0%
n_episode :6200, score : 465.1, n_buffer : 25000, eps : 1.0%
n_episode :6220, score : 461.4, n_buffer : 25000, eps : 1.0%
n_episode :6240, score : 500.0, n_buffer : 25000, eps : 1.0%
n_episode :6260, score : 459.8, n_buffer : 25000, eps : 1.0%
n_episode :6280, score : 480.9, n_buffer : 25000, eps : 1.0%
n_episode :6300, score : 500.0, n_buffer : 25000, eps : 1.0%
n_episode :6320, score : 500.0, n_buffer : 25000, eps : 1.0%
n_episode :6340, score : 500.0, n_buffer : 25000, eps : 1.0%
n_episode :6360, score : 500.0, n_buffer : 25000, eps : 1.0%
n_episode :6380, score : 438.9, n_buffer : 25000, eps : 1.0%
n_episode :6400, score : 468.4, n_buffer : 25000, eps : 1.0%
n_episode :6420, score : 500.0, n_buffer : 25000, eps : 1.0%
n_episode :6440, score : 356.1, n_buffer : 25000, eps : 1.0%
n_episode :6460, score : 409.9, n_buffer : 25000, eps : 1.0%
n_episode :6480, score : 357.2, n_buffer : 25000, eps : 1.0%
n_episode :6500, score : 407.2, n_buffer : 25000, eps : 1.0%
n_episode :6520, score : 485.1, n_buffer : 25000, eps : 1.0%
n_episode :6540, score : 462.4, n_buffer : 25000, eps : 1.0%
n_episode :6560, score : 500.0, n_buffer : 25000, eps : 1.0%
n_episode :6580, score : 481.2, n_buffer : 25000, eps : 1.0%
n_episode :6600, score : 461.4, n_buffer : 25000, eps : 1.0%
n_episode :6620, score : 368.6, n_buffer : 25000, eps : 1.0%
n_episode :6640, score : 500.0, n_buffer : 25000, eps : 1.0%
n_episode :6660, score : 404.8, n_buffer : 25000, eps : 1.0%
n_episode :6680, score : 476.2, n_buffer : 25000, eps : 1.0%
n_episode :6700, score : 490.8, n_buffer : 25000, eps : 1.0%
n_episode :6720, score : 462.6, n_buffer : 25000, eps : 1.0%
n_episode :6740, score : 478.7, n_buffer : 25000, eps : 1.0%
n_episode :6760, score : 475.6, n_buffer : 25000, eps : 1.0%
n_episode :6780, score : 489.6, n_buffer : 25000, eps : 1.0%
n_episode :6800, score : 460.4, n_buffer : 25000, eps : 1.0%
n_episode :6820, score : 422.2, n_buffer : 25000, eps : 1.0%
n_episode :6840, score : 217.2, n_buffer : 25000, eps : 1.0%
n_episode :6860, score : 353.2, n_buffer : 25000, eps : 1.0%
n_episode :6880, score : 201.1, n_buffer : 25000, eps : 1.0%
n_episode :6900, score : 387.2, n_buffer : 25000, eps : 1.0%
n_episode :6920, score : 434.3, n_buffer : 25000, eps : 1.0%
n_episode :6940, score : 500.0, n_buffer : 25000, eps : 1.0%
n_episode :6960, score : 500.0, n_buffer : 25000, eps : 1.0%
```

```
n_episode :6980, score : 500.0, n_buffer : 25000, eps : 1.0%
n_episode :7000, score : 402.1, n_buffer : 25000, eps : 1.0%
n_episode :7020, score : 455.9, n_buffer : 25000, eps : 1.0%
n_episode :7040, score : 427.0, n_buffer : 25000, eps : 1.0%
n_episode :7060, score : 466.2, n_buffer : 25000, eps : 1.0%
n_episode :7080, score : 480.9, n_buffer : 25000, eps : 1.0%
n_episode :7100, score : 392.9, n_buffer : 25000, eps : 1.0%
n_episode :7120, score : 287.6, n_buffer : 25000, eps : 1.0%
n_episode :7140, score : 385.2, n_buffer : 25000, eps : 1.0%
n_episode :7160, score : 465.4, n_buffer : 25000, eps : 1.0%
n_episode :7180, score : 500.0, n_buffer : 25000, eps : 1.0%
n_episode :7200, score : 481.6, n_buffer : 25000, eps : 1.0%
n_episode :7220, score : 364.4, n_buffer : 25000, eps : 1.0%
n_episode :7240, score : 403.9, n_buffer : 25000, eps : 1.0%
n_episode :7260, score : 392.8, n_buffer : 25000, eps : 1.0%
n_episode :7280, score : 439.9, n_buffer : 25000, eps : 1.0%
n_episode :7300, score : 373.1, n_buffer : 25000, eps : 1.0%
n_episode :7320, score : 462.1, n_buffer : 25000, eps : 1.0%
n_episode :7340, score : 352.0, n_buffer : 25000, eps : 1.0%
n_episode :7360, score : 290.4, n_buffer : 25000, eps : 1.0%
n_episode :7380, score : 256.4, n_buffer : 25000, eps : 1.0%
n_episode :7400, score : 211.7, n_buffer : 25000, eps : 1.0%
n_episode :7420, score : 265.4, n_buffer : 25000, eps : 1.0%
n_episode :7440, score : 349.9, n_buffer : 25000, eps : 1.0%
n_episode :7460, score : 263.4, n_buffer : 25000, eps : 1.0%
n_episode :7480, score : 238.2, n_buffer : 25000, eps : 1.0%
n_episode :7500, score : 263.8, n_buffer : 25000, eps : 1.0%
n_episode :7520, score : 224.2, n_buffer : 25000, eps : 1.0%
n_episode :7540, score : 335.9, n_buffer : 25000, eps : 1.0%
n_episode :7560, score : 406.9, n_buffer : 25000, eps : 1.0%
n_episode :7580, score : 411.4, n_buffer : 25000, eps : 1.0%
n_episode :7600, score : 348.1, n_buffer : 25000, eps : 1.0%
n_episode :7620, score : 368.1, n_buffer : 25000, eps : 1.0%
n_episode :7640, score : 411.3, n_buffer : 25000, eps : 1.0%
n_episode :7660, score : 428.4, n_buffer : 25000, eps : 1.0%
n_episode :7680, score : 393.1, n_buffer : 25000, eps : 1.0%
n_episode :7700, score : 441.3, n_buffer : 25000, eps : 1.0%
n_episode :7720, score : 338.1, n_buffer : 25000, eps : 1.0%
n_episode :7740, score : 310.9, n_buffer : 25000, eps : 1.0%
n_episode :7760, score : 347.9, n_buffer : 25000, eps : 1.0%
n_episode :7780, score : 388.9, n_buffer : 25000, eps : 1.0%
n_episode :7800, score : 331.2, n_buffer : 25000, eps : 1.0%
n_episode :7820, score : 317.8, n_buffer : 25000, eps : 1.0%
n_episode :7840, score : 324.3, n_buffer : 25000, eps : 1.0%
n_episode :7860, score : 192.2, n_buffer : 25000, eps : 1.0%
n_episode :7880, score : 212.4, n_buffer : 25000, eps : 1.0%
n_episode :7900, score : 249.2, n_buffer : 25000, eps : 1.0%
n_episode :7920, score : 296.6, n_buffer : 25000, eps : 1.0%
```

```
n_episode :7940, score : 339.9, n_buffer : 25000, eps : 1.0%
n_episode :7960, score : 299.8, n_buffer : 25000, eps : 1.0%
n_episode :7980, score : 394.7, n_buffer : 25000, eps : 1.0%
n_episode :8000, score : 354.6, n_buffer : 25000, eps : 1.0%
n_episode :8020, score : 389.4, n_buffer : 25000, eps : 1.0%
n_episode :8040, score : 424.6, n_buffer : 25000, eps : 1.0%
n_episode :8060, score : 203.8, n_buffer : 25000, eps : 1.0%
n_episode :8080, score : 294.4, n_buffer : 25000, eps : 1.0%
n_episode :8100, score : 371.2, n_buffer : 25000, eps : 1.0%
n_episode :8120, score : 395.6, n_buffer : 25000, eps : 1.0%
n_episode :8140, score : 470.6, n_buffer : 25000, eps : 1.0%
n_episode :8160, score : 342.9, n_buffer : 25000, eps : 1.0%
n_episode :8180, score : 479.2, n_buffer : 25000, eps : 1.0%
n_episode :8200, score : 500.0, n_buffer : 25000, eps : 1.0%
n_episode :8220, score : 456.4, n_buffer : 25000, eps : 1.0%
n_episode :8240, score : 340.0, n_buffer : 25000, eps : 1.0%
n_episode :8260, score : 429.8, n_buffer : 25000, eps : 1.0%
n_episode :8280, score : 229.4, n_buffer : 25000, eps : 1.0%
n_episode :8300, score : 376.0, n_buffer : 25000, eps : 1.0%
n_episode :8320, score : 350.5, n_buffer : 25000, eps : 1.0%
n_episode :8340, score : 451.2, n_buffer : 25000, eps : 1.0%
n_episode :8360, score : 487.3, n_buffer : 25000, eps : 1.0%
n_episode :8380, score : 500.0, n_buffer : 25000, eps : 1.0%
n_episode :8400, score : 456.9, n_buffer : 25000, eps : 1.0%
n_episode :8420, score : 449.9, n_buffer : 25000, eps : 1.0%
n_episode :8440, score : 423.6, n_buffer : 25000, eps : 1.0%
n_episode :8460, score : 233.1, n_buffer : 25000, eps : 1.0%
n_episode :8480, score : 338.9, n_buffer : 25000, eps : 1.0%
n_episode :8500, score : 369.5, n_buffer : 25000, eps : 1.0%
n_episode :8520, score : 438.2, n_buffer : 25000, eps : 1.0%
n_episode :8540, score : 446.6, n_buffer : 25000, eps : 1.0%
n_episode :8560, score : 413.6, n_buffer : 25000, eps : 1.0%
n_episode :8580, score : 299.2, n_buffer : 25000, eps : 1.0%
n_episode :8600, score : 344.6, n_buffer : 25000, eps : 1.0%
n_episode :8620, score : 375.9, n_buffer : 25000, eps : 1.0%
n_episode :8640, score : 436.4, n_buffer : 25000, eps : 1.0%
n_episode :8660, score : 406.6, n_buffer : 25000, eps : 1.0%
n_episode :8680, score : 486.9, n_buffer : 25000, eps : 1.0%
n_episode :8700, score : 486.7, n_buffer : 25000, eps : 1.0%
n_episode :8720, score : 484.1, n_buffer : 25000, eps : 1.0%
n_episode :8740, score : 494.3, n_buffer : 25000, eps : 1.0%
n_episode :8760, score : 500.0, n_buffer : 25000, eps : 1.0%
n_episode :8780, score : 484.9, n_buffer : 25000, eps : 1.0%
n_episode :8800, score : 494.4, n_buffer : 25000, eps : 1.0%
n_episode :8820, score : 443.4, n_buffer : 25000, eps : 1.0%
n_episode :8840, score : 482.0, n_buffer : 25000, eps : 1.0%
n_episode :8860, score : 488.4, n_buffer : 25000, eps : 1.0%
n_episode :8880, score : 420.1, n_buffer : 25000, eps : 1.0%
```

```
n_episode :8900, score : 416.9, n_buffer : 25000, eps : 1.0%
n_episode :8920, score : 454.0, n_buffer : 25000, eps : 1.0%
n_episode :8940, score : 500.0, n_buffer : 25000, eps : 1.0%
n_episode :8960, score : 500.0, n_buffer : 25000, eps : 1.0%
n_episode :8980, score : 485.8, n_buffer : 25000, eps : 1.0%
n_episode :9000, score : 428.5, n_buffer : 25000, eps : 1.0%
n_episode :9020, score : 483.2, n_buffer : 25000, eps : 1.0%
n_episode :9040, score : 476.2, n_buffer : 25000, eps : 1.0%
n_episode :9060, score : 500.0, n_buffer : 25000, eps : 1.0%
n_episode :9080, score : 336.8, n_buffer : 25000, eps : 1.0%
n_episode :9100, score : 288.6, n_buffer : 25000, eps : 1.0%
n_episode :9120, score : 345.1, n_buffer : 25000, eps : 1.0%
n_episode :9140, score : 345.1, n_buffer : 25000, eps : 1.0%
n_episode :9160, score : 359.4, n_buffer : 25000, eps : 1.0%
n_episode :9180, score : 207.1, n_buffer : 25000, eps : 1.0%
n_episode :9200, score : 322.2, n_buffer : 25000, eps : 1.0%
n_episode :9220, score : 191.8, n_buffer : 25000, eps : 1.0%
n_episode :9240, score : 316.8, n_buffer : 25000, eps : 1.0%
n_episode :9260, score : 341.5, n_buffer : 25000, eps : 1.0%
n_episode :9280, score : 372.4, n_buffer : 25000, eps : 1.0%
n_episode :9300, score : 353.1, n_buffer : 25000, eps : 1.0%
n_episode :9320, score : 377.2, n_buffer : 25000, eps : 1.0%
n_episode :9340, score : 322.4, n_buffer : 25000, eps : 1.0%
n_episode :9360, score : 358.0, n_buffer : 25000, eps : 1.0%
n_episode :9380, score : 413.6, n_buffer : 25000, eps : 1.0%
n_episode :9400, score : 252.2, n_buffer : 25000, eps : 1.0%
n_episode :9420, score : 302.9, n_buffer : 25000, eps : 1.0%
n_episode :9440, score : 449.1, n_buffer : 25000, eps : 1.0%
n_episode :9460, score : 434.4, n_buffer : 25000, eps : 1.0%
n_episode :9480, score : 392.8, n_buffer : 25000, eps : 1.0%
n_episode :9500, score : 383.9, n_buffer : 25000, eps : 1.0%
n_episode :9520, score : 359.8, n_buffer : 25000, eps : 1.0%
n_episode :9540, score : 208.7, n_buffer : 25000, eps : 1.0%
n_episode :9560, score : 339.7, n_buffer : 25000, eps : 1.0%
n_episode :9580, score : 370.6, n_buffer : 25000, eps : 1.0%
n_episode :9600, score : 425.4, n_buffer : 25000, eps : 1.0%
n_episode :9620, score : 400.5, n_buffer : 25000, eps : 1.0%
n_episode :9640, score : 453.7, n_buffer : 25000, eps : 1.0%
n_episode :9660, score : 327.4, n_buffer : 25000, eps : 1.0%
n_episode :9680, score : 313.1, n_buffer : 25000, eps : 1.0%
n_episode :9700, score : 271.6, n_buffer : 25000, eps : 1.0%
n_episode :9720, score : 409.9, n_buffer : 25000, eps : 1.0%
n_episode :9740, score : 290.1, n_buffer : 25000, eps : 1.0%
n_episode :9760, score : 394.9, n_buffer : 25000, eps : 1.0%
n_episode :9780, score : 334.3, n_buffer : 25000, eps : 1.0%
n_episode :9800, score : 337.5, n_buffer : 25000, eps : 1.0%
n_episode :9820, score : 246.4, n_buffer : 25000, eps : 1.0%
n_episode :9840, score : 139.2, n_buffer : 25000, eps : 1.0%
```

```
n_episode :9860, score : 120.7, n_buffer : 25000, eps : 1.0%
n_episode :9880, score : 104.8, n_buffer : 25000, eps : 1.0%
n_episode :9900, score : 256.9, n_buffer : 25000, eps : 1.0%
n_episode :9920, score : 343.1, n_buffer : 25000, eps : 1.0%
n_episode :9940, score : 403.9, n_buffer : 25000, eps : 1.0%
n_episode :9960, score : 276.1, n_buffer : 25000, eps : 1.0%
n_episode :9980, score : 226.1, n_buffer : 25000, eps : 1.0%
```



when we change the buffer limit value from 50000 to 25000, we can also see that the scores are smaller in this case.

[16]:
```
#Change gamma from 0.98 to 0.75

#Hyperparameters
learning_rate = 0.0005
gamma         = 0.75
buffer_limit  = 50000
batch_size    = 32

if __name__ == '__main__':
    main()
    plt.show()
```

```
n_episode :20, score : 81.8, n_buffer : 1636, eps : 7.9%
n_episode :40, score : 35.5, n_buffer : 2347, eps : 7.8%
n_episode :60, score : 41.5, n_buffer : 3177, eps : 7.7%
n_episode :80, score : 39.1, n_buffer : 3960, eps : 7.6%
```

```
n_episode :100, score : 42.0, n_buffer : 4801, eps : 7.5%
n_episode :120, score : 47.9, n_buffer : 5759, eps : 7.4%
n_episode :140, score : 26.4, n_buffer : 6286, eps : 7.3%
n_episode :160, score : 60.6, n_buffer : 7498, eps : 7.2%
n_episode :180, score : 28.1, n_buffer : 8060, eps : 7.1%
n_episode :200, score : 38.8, n_buffer : 8836, eps : 7.0%
n_episode :220, score : 27.8, n_buffer : 9392, eps : 6.9%
n_episode :240, score : 48.2, n_buffer : 10357, eps : 6.8%
n_episode :260, score : 80.2, n_buffer : 11960, eps : 6.7%
n_episode :280, score : 94.5, n_buffer : 13850, eps : 6.6%
n_episode :300, score : 67.8, n_buffer : 15207, eps : 6.5%
n_episode :320, score : 78.0, n_buffer : 16766, eps : 6.4%
n_episode :340, score : 103.7, n_buffer : 18839, eps : 6.3%
n_episode :360, score : 114.4, n_buffer : 21127, eps : 6.2%
n_episode :380, score : 71.5, n_buffer : 22557, eps : 6.1%
n_episode :400, score : 52.2, n_buffer : 23602, eps : 6.0%
n_episode :420, score : 133.3, n_buffer : 26269, eps : 5.9%
n_episode :440, score : 160.7, n_buffer : 29483, eps : 5.8%
n_episode :460, score : 172.7, n_buffer : 32936, eps : 5.7%
n_episode :480, score : 120.2, n_buffer : 35341, eps : 5.6%
n_episode :500, score : 111.9, n_buffer : 37579, eps : 5.5%
n_episode :520, score : 130.1, n_buffer : 40180, eps : 5.4%
n_episode :540, score : 136.8, n_buffer : 42915, eps : 5.3%
n_episode :560, score : 120.1, n_buffer : 45317, eps : 5.2%
n_episode :580, score : 82.0, n_buffer : 46958, eps : 5.1%
n_episode :600, score : 164.2, n_buffer : 50000, eps : 5.0%
n_episode :620, score : 83.2, n_buffer : 50000, eps : 4.9%
n_episode :640, score : 110.4, n_buffer : 50000, eps : 4.8%
n_episode :660, score : 82.5, n_buffer : 50000, eps : 4.7%
n_episode :680, score : 109.2, n_buffer : 50000, eps : 4.6%
n_episode :700, score : 123.6, n_buffer : 50000, eps : 4.5%
n_episode :720, score : 104.3, n_buffer : 50000, eps : 4.4%
n_episode :740, score : 173.3, n_buffer : 50000, eps : 4.3%
n_episode :760, score : 114.9, n_buffer : 50000, eps : 4.2%
n_episode :780, score : 98.0, n_buffer : 50000, eps : 4.1%
n_episode :800, score : 83.2, n_buffer : 50000, eps : 4.0%
n_episode :820, score : 169.8, n_buffer : 50000, eps : 3.9%
n_episode :840, score : 140.6, n_buffer : 50000, eps : 3.8%
n_episode :860, score : 181.3, n_buffer : 50000, eps : 3.7%
n_episode :880, score : 73.0, n_buffer : 50000, eps : 3.6%
n_episode :900, score : 195.0, n_buffer : 50000, eps : 3.5%
n_episode :920, score : 128.7, n_buffer : 50000, eps : 3.4%
n_episode :940, score : 206.6, n_buffer : 50000, eps : 3.3%
n_episode :960, score : 257.8, n_buffer : 50000, eps : 3.2%
n_episode :980, score : 213.4, n_buffer : 50000, eps : 3.1%
n_episode :1000, score : 200.4, n_buffer : 50000, eps : 3.0%
n_episode :1020, score : 258.4, n_buffer : 50000, eps : 2.9%
n_episode :1040, score : 138.8, n_buffer : 50000, eps : 2.8%
```

```
n_episode :1060, score : 120.0, n_buffer : 50000, eps : 2.7%
n_episode :1080, score : 209.3, n_buffer : 50000, eps : 2.6%
n_episode :1100, score : 347.6, n_buffer : 50000, eps : 2.5%
n_episode :1120, score : 210.2, n_buffer : 50000, eps : 2.4%
n_episode :1140, score : 140.7, n_buffer : 50000, eps : 2.3%
n_episode :1160, score : 176.1, n_buffer : 50000, eps : 2.2%
n_episode :1180, score : 218.6, n_buffer : 50000, eps : 2.1%
n_episode :1200, score : 350.6, n_buffer : 50000, eps : 2.0%
n_episode :1220, score : 283.1, n_buffer : 50000, eps : 1.9%
n_episode :1240, score : 278.1, n_buffer : 50000, eps : 1.8%
n_episode :1260, score : 184.1, n_buffer : 50000, eps : 1.7%
n_episode :1280, score : 233.8, n_buffer : 50000, eps : 1.6%
n_episode :1300, score : 255.9, n_buffer : 50000, eps : 1.5%
n_episode :1320, score : 118.2, n_buffer : 50000, eps : 1.4%
n_episode :1340, score : 217.2, n_buffer : 50000, eps : 1.3%
n_episode :1360, score : 192.8, n_buffer : 50000, eps : 1.2%
n_episode :1380, score : 285.7, n_buffer : 50000, eps : 1.1%
n_episode :1400, score : 63.3, n_buffer : 50000, eps : 1.0%
n_episode :1420, score : 127.2, n_buffer : 50000, eps : 1.0%
n_episode :1440, score : 204.8, n_buffer : 50000, eps : 1.0%
n_episode :1460, score : 176.2, n_buffer : 50000, eps : 1.0%
n_episode :1480, score : 69.0, n_buffer : 50000, eps : 1.0%
n_episode :1500, score : 85.3, n_buffer : 50000, eps : 1.0%
n_episode :1520, score : 165.3, n_buffer : 50000, eps : 1.0%
n_episode :1540, score : 102.8, n_buffer : 50000, eps : 1.0%
n_episode :1560, score : 175.8, n_buffer : 50000, eps : 1.0%
n_episode :1580, score : 133.2, n_buffer : 50000, eps : 1.0%
n_episode :1600, score : 217.8, n_buffer : 50000, eps : 1.0%
n_episode :1620, score : 162.3, n_buffer : 50000, eps : 1.0%
n_episode :1640, score : 165.0, n_buffer : 50000, eps : 1.0%
n_episode :1660, score : 160.8, n_buffer : 50000, eps : 1.0%
n_episode :1680, score : 220.8, n_buffer : 50000, eps : 1.0%
n_episode :1700, score : 172.7, n_buffer : 50000, eps : 1.0%
n_episode :1720, score : 192.2, n_buffer : 50000, eps : 1.0%
n_episode :1740, score : 172.8, n_buffer : 50000, eps : 1.0%
n_episode :1760, score : 140.3, n_buffer : 50000, eps : 1.0%
n_episode :1780, score : 108.6, n_buffer : 50000, eps : 1.0%
n_episode :1800, score : 145.7, n_buffer : 50000, eps : 1.0%
n_episode :1820, score : 180.6, n_buffer : 50000, eps : 1.0%
n_episode :1840, score : 82.7, n_buffer : 50000, eps : 1.0%
n_episode :1860, score : 94.2, n_buffer : 50000, eps : 1.0%
n_episode :1880, score : 132.6, n_buffer : 50000, eps : 1.0%
n_episode :1900, score : 98.2, n_buffer : 50000, eps : 1.0%
n_episode :1920, score : 97.2, n_buffer : 50000, eps : 1.0%
n_episode :1940, score : 41.2, n_buffer : 50000, eps : 1.0%
n_episode :1960, score : 97.5, n_buffer : 50000, eps : 1.0%
n_episode :1980, score : 88.8, n_buffer : 50000, eps : 1.0%
n_episode :2000, score : 97.8, n_buffer : 50000, eps : 1.0%
```

```
n_episode :2020, score : 109.9, n_buffer : 50000, eps : 1.0%
n_episode :2040, score : 120.0, n_buffer : 50000, eps : 1.0%
n_episode :2060, score : 91.9, n_buffer : 50000, eps : 1.0%
n_episode :2080, score : 73.5, n_buffer : 50000, eps : 1.0%
n_episode :2100, score : 89.5, n_buffer : 50000, eps : 1.0%
n_episode :2120, score : 94.2, n_buffer : 50000, eps : 1.0%
n_episode :2140, score : 73.8, n_buffer : 50000, eps : 1.0%
n_episode :2160, score : 48.5, n_buffer : 50000, eps : 1.0%
n_episode :2180, score : 101.3, n_buffer : 50000, eps : 1.0%
n_episode :2200, score : 97.1, n_buffer : 50000, eps : 1.0%
n_episode :2220, score : 90.2, n_buffer : 50000, eps : 1.0%
n_episode :2240, score : 93.3, n_buffer : 50000, eps : 1.0%
n_episode :2260, score : 122.5, n_buffer : 50000, eps : 1.0%
n_episode :2280, score : 126.0, n_buffer : 50000, eps : 1.0%
n_episode :2300, score : 102.8, n_buffer : 50000, eps : 1.0%
n_episode :2320, score : 101.3, n_buffer : 50000, eps : 1.0%
n_episode :2340, score : 119.9, n_buffer : 50000, eps : 1.0%
n_episode :2360, score : 82.5, n_buffer : 50000, eps : 1.0%
n_episode :2380, score : 118.8, n_buffer : 50000, eps : 1.0%
n_episode :2400, score : 116.0, n_buffer : 50000, eps : 1.0%
n_episode :2420, score : 97.8, n_buffer : 50000, eps : 1.0%
n_episode :2440, score : 117.2, n_buffer : 50000, eps : 1.0%
n_episode :2460, score : 114.2, n_buffer : 50000, eps : 1.0%
n_episode :2480, score : 108.8, n_buffer : 50000, eps : 1.0%
n_episode :2500, score : 115.4, n_buffer : 50000, eps : 1.0%
n_episode :2520, score : 100.2, n_buffer : 50000, eps : 1.0%
n_episode :2540, score : 117.7, n_buffer : 50000, eps : 1.0%
n_episode :2560, score : 114.8, n_buffer : 50000, eps : 1.0%
n_episode :2580, score : 124.1, n_buffer : 50000, eps : 1.0%
n_episode :2600, score : 114.2, n_buffer : 50000, eps : 1.0%
n_episode :2620, score : 98.9, n_buffer : 50000, eps : 1.0%
n_episode :2640, score : 94.5, n_buffer : 50000, eps : 1.0%
n_episode :2660, score : 102.2, n_buffer : 50000, eps : 1.0%
n_episode :2680, score : 104.8, n_buffer : 50000, eps : 1.0%
n_episode :2700, score : 83.5, n_buffer : 50000, eps : 1.0%
n_episode :2720, score : 94.0, n_buffer : 50000, eps : 1.0%
n_episode :2740, score : 100.0, n_buffer : 50000, eps : 1.0%
n_episode :2760, score : 68.9, n_buffer : 50000, eps : 1.0%
n_episode :2780, score : 55.0, n_buffer : 50000, eps : 1.0%
n_episode :2800, score : 84.0, n_buffer : 50000, eps : 1.0%
n_episode :2820, score : 102.2, n_buffer : 50000, eps : 1.0%
n_episode :2840, score : 83.2, n_buffer : 50000, eps : 1.0%
n_episode :2860, score : 69.9, n_buffer : 50000, eps : 1.0%
n_episode :2880, score : 44.4, n_buffer : 50000, eps : 1.0%
n_episode :2900, score : 75.9, n_buffer : 50000, eps : 1.0%
n_episode :2920, score : 106.2, n_buffer : 50000, eps : 1.0%
n_episode :2940, score : 110.0, n_buffer : 50000, eps : 1.0%
n_episode :2960, score : 80.9, n_buffer : 50000, eps : 1.0%
```

```
n_episode :2980, score : 92.8, n_buffer : 50000, eps : 1.0%
n_episode :3000, score : 98.0, n_buffer : 50000, eps : 1.0%
n_episode :3020, score : 89.3, n_buffer : 50000, eps : 1.0%
n_episode :3040, score : 91.3, n_buffer : 50000, eps : 1.0%
n_episode :3060, score : 86.9, n_buffer : 50000, eps : 1.0%
n_episode :3080, score : 105.0, n_buffer : 50000, eps : 1.0%
n_episode :3100, score : 97.2, n_buffer : 50000, eps : 1.0%
n_episode :3120, score : 129.3, n_buffer : 50000, eps : 1.0%
n_episode :3140, score : 121.0, n_buffer : 50000, eps : 1.0%
n_episode :3160, score : 116.7, n_buffer : 50000, eps : 1.0%
n_episode :3180, score : 117.7, n_buffer : 50000, eps : 1.0%
n_episode :3200, score : 103.0, n_buffer : 50000, eps : 1.0%
n_episode :3220, score : 85.7, n_buffer : 50000, eps : 1.0%
n_episode :3240, score : 74.2, n_buffer : 50000, eps : 1.0%
n_episode :3260, score : 136.6, n_buffer : 50000, eps : 1.0%
n_episode :3280, score : 118.7, n_buffer : 50000, eps : 1.0%
n_episode :3300, score : 102.1, n_buffer : 50000, eps : 1.0%
n_episode :3320, score : 137.7, n_buffer : 50000, eps : 1.0%
n_episode :3340, score : 106.2, n_buffer : 50000, eps : 1.0%
n_episode :3360, score : 148.6, n_buffer : 50000, eps : 1.0%
n_episode :3380, score : 109.2, n_buffer : 50000, eps : 1.0%
n_episode :3400, score : 106.9, n_buffer : 50000, eps : 1.0%
n_episode :3420, score : 119.6, n_buffer : 50000, eps : 1.0%
n_episode :3440, score : 125.0, n_buffer : 50000, eps : 1.0%
n_episode :3460, score : 95.7, n_buffer : 50000, eps : 1.0%
n_episode :3480, score : 123.8, n_buffer : 50000, eps : 1.0%
n_episode :3500, score : 92.9, n_buffer : 50000, eps : 1.0%
n_episode :3520, score : 100.1, n_buffer : 50000, eps : 1.0%
n_episode :3540, score : 117.5, n_buffer : 50000, eps : 1.0%
n_episode :3560, score : 102.8, n_buffer : 50000, eps : 1.0%
n_episode :3580, score : 98.3, n_buffer : 50000, eps : 1.0%
n_episode :3600, score : 76.7, n_buffer : 50000, eps : 1.0%
n_episode :3620, score : 40.2, n_buffer : 50000, eps : 1.0%
n_episode :3640, score : 77.2, n_buffer : 50000, eps : 1.0%
n_episode :3660, score : 96.8, n_buffer : 50000, eps : 1.0%
n_episode :3680, score : 104.8, n_buffer : 50000, eps : 1.0%
n_episode :3700, score : 107.8, n_buffer : 50000, eps : 1.0%
n_episode :3720, score : 81.7, n_buffer : 50000, eps : 1.0%
n_episode :3740, score : 148.8, n_buffer : 50000, eps : 1.0%
n_episode :3760, score : 105.3, n_buffer : 50000, eps : 1.0%
n_episode :3780, score : 80.3, n_buffer : 50000, eps : 1.0%
n_episode :3800, score : 56.5, n_buffer : 50000, eps : 1.0%
n_episode :3820, score : 69.0, n_buffer : 50000, eps : 1.0%
n_episode :3840, score : 121.7, n_buffer : 50000, eps : 1.0%
n_episode :3860, score : 80.1, n_buffer : 50000, eps : 1.0%
n_episode :3880, score : 85.4, n_buffer : 50000, eps : 1.0%
n_episode :3900, score : 108.2, n_buffer : 50000, eps : 1.0%
n_episode :3920, score : 114.7, n_buffer : 50000, eps : 1.0%
```

```
n_episode :3940, score : 108.0, n_buffer : 50000, eps : 1.0%
n_episode :3960, score : 111.0, n_buffer : 50000, eps : 1.0%
n_episode :3980, score : 94.0, n_buffer : 50000, eps : 1.0%
n_episode :4000, score : 88.0, n_buffer : 50000, eps : 1.0%
n_episode :4020, score : 125.5, n_buffer : 50000, eps : 1.0%
n_episode :4040, score : 130.3, n_buffer : 50000, eps : 1.0%
n_episode :4060, score : 128.0, n_buffer : 50000, eps : 1.0%
n_episode :4080, score : 120.0, n_buffer : 50000, eps : 1.0%
n_episode :4100, score : 117.5, n_buffer : 50000, eps : 1.0%
n_episode :4120, score : 96.0, n_buffer : 50000, eps : 1.0%
n_episode :4140, score : 77.4, n_buffer : 50000, eps : 1.0%
n_episode :4160, score : 94.7, n_buffer : 50000, eps : 1.0%
n_episode :4180, score : 129.2, n_buffer : 50000, eps : 1.0%
n_episode :4200, score : 134.8, n_buffer : 50000, eps : 1.0%
n_episode :4220, score : 132.2, n_buffer : 50000, eps : 1.0%
n_episode :4240, score : 125.8, n_buffer : 50000, eps : 1.0%
n_episode :4260, score : 107.5, n_buffer : 50000, eps : 1.0%
n_episode :4280, score : 110.0, n_buffer : 50000, eps : 1.0%
n_episode :4300, score : 101.8, n_buffer : 50000, eps : 1.0%
n_episode :4320, score : 94.7, n_buffer : 50000, eps : 1.0%
n_episode :4340, score : 89.2, n_buffer : 50000, eps : 1.0%
n_episode :4360, score : 90.5, n_buffer : 50000, eps : 1.0%
n_episode :4380, score : 102.8, n_buffer : 50000, eps : 1.0%
n_episode :4400, score : 108.2, n_buffer : 50000, eps : 1.0%
n_episode :4420, score : 54.5, n_buffer : 50000, eps : 1.0%
n_episode :4440, score : 98.0, n_buffer : 50000, eps : 1.0%
n_episode :4460, score : 71.9, n_buffer : 50000, eps : 1.0%
n_episode :4480, score : 122.0, n_buffer : 50000, eps : 1.0%
n_episode :4500, score : 87.5, n_buffer : 50000, eps : 1.0%
n_episode :4520, score : 63.6, n_buffer : 50000, eps : 1.0%
n_episode :4540, score : 118.9, n_buffer : 50000, eps : 1.0%
n_episode :4560, score : 92.6, n_buffer : 50000, eps : 1.0%
n_episode :4580, score : 119.8, n_buffer : 50000, eps : 1.0%
n_episode :4600, score : 109.2, n_buffer : 50000, eps : 1.0%
n_episode :4620, score : 97.6, n_buffer : 50000, eps : 1.0%
n_episode :4640, score : 63.5, n_buffer : 50000, eps : 1.0%
n_episode :4660, score : 63.9, n_buffer : 50000, eps : 1.0%
n_episode :4680, score : 54.9, n_buffer : 50000, eps : 1.0%
n_episode :4700, score : 62.2, n_buffer : 50000, eps : 1.0%
n_episode :4720, score : 65.2, n_buffer : 50000, eps : 1.0%
n_episode :4740, score : 57.5, n_buffer : 50000, eps : 1.0%
n_episode :4760, score : 60.4, n_buffer : 50000, eps : 1.0%
n_episode :4780, score : 69.5, n_buffer : 50000, eps : 1.0%
n_episode :4800, score : 37.1, n_buffer : 50000, eps : 1.0%
n_episode :4820, score : 36.5, n_buffer : 50000, eps : 1.0%
n_episode :4840, score : 29.6, n_buffer : 50000, eps : 1.0%
n_episode :4860, score : 29.9, n_buffer : 50000, eps : 1.0%
n_episode :4880, score : 39.8, n_buffer : 50000, eps : 1.0%
```

```
n_episode :4900, score : 54.9, n_buffer : 50000, eps : 1.0%
n_episode :4920, score : 71.0, n_buffer : 50000, eps : 1.0%
n_episode :4940, score : 51.0, n_buffer : 50000, eps : 1.0%
n_episode :4960, score : 64.8, n_buffer : 50000, eps : 1.0%
n_episode :4980, score : 64.2, n_buffer : 50000, eps : 1.0%
n_episode :5000, score : 61.3, n_buffer : 50000, eps : 1.0%
n_episode :5020, score : 90.2, n_buffer : 50000, eps : 1.0%
n_episode :5040, score : 77.7, n_buffer : 50000, eps : 1.0%
n_episode :5060, score : 91.7, n_buffer : 50000, eps : 1.0%
n_episode :5080, score : 98.7, n_buffer : 50000, eps : 1.0%
n_episode :5100, score : 83.3, n_buffer : 50000, eps : 1.0%
n_episode :5120, score : 90.8, n_buffer : 50000, eps : 1.0%
n_episode :5140, score : 69.1, n_buffer : 50000, eps : 1.0%
n_episode :5160, score : 79.8, n_buffer : 50000, eps : 1.0%
n_episode :5180, score : 71.1, n_buffer : 50000, eps : 1.0%
n_episode :5200, score : 63.4, n_buffer : 50000, eps : 1.0%
n_episode :5220, score : 71.0, n_buffer : 50000, eps : 1.0%
n_episode :5240, score : 55.4, n_buffer : 50000, eps : 1.0%
n_episode :5260, score : 51.5, n_buffer : 50000, eps : 1.0%
n_episode :5280, score : 82.2, n_buffer : 50000, eps : 1.0%
n_episode :5300, score : 62.4, n_buffer : 50000, eps : 1.0%
n_episode :5320, score : 72.3, n_buffer : 50000, eps : 1.0%
n_episode :5340, score : 71.2, n_buffer : 50000, eps : 1.0%
n_episode :5360, score : 68.0, n_buffer : 50000, eps : 1.0%
n_episode :5380, score : 66.2, n_buffer : 50000, eps : 1.0%
n_episode :5400, score : 73.6, n_buffer : 50000, eps : 1.0%
n_episode :5420, score : 56.6, n_buffer : 50000, eps : 1.0%
n_episode :5440, score : 80.2, n_buffer : 50000, eps : 1.0%
n_episode :5460, score : 76.5, n_buffer : 50000, eps : 1.0%
n_episode :5480, score : 70.5, n_buffer : 50000, eps : 1.0%
n_episode :5500, score : 79.5, n_buffer : 50000, eps : 1.0%
n_episode :5520, score : 70.6, n_buffer : 50000, eps : 1.0%
n_episode :5540, score : 83.3, n_buffer : 50000, eps : 1.0%
n_episode :5560, score : 91.2, n_buffer : 50000, eps : 1.0%
n_episode :5580, score : 76.1, n_buffer : 50000, eps : 1.0%
n_episode :5600, score : 55.4, n_buffer : 50000, eps : 1.0%
n_episode :5620, score : 69.5, n_buffer : 50000, eps : 1.0%
n_episode :5640, score : 87.3, n_buffer : 50000, eps : 1.0%
n_episode :5660, score : 68.2, n_buffer : 50000, eps : 1.0%
n_episode :5680, score : 87.2, n_buffer : 50000, eps : 1.0%
n_episode :5700, score : 81.0, n_buffer : 50000, eps : 1.0%
n_episode :5720, score : 90.2, n_buffer : 50000, eps : 1.0%
n_episode :5740, score : 76.3, n_buffer : 50000, eps : 1.0%
n_episode :5760, score : 72.8, n_buffer : 50000, eps : 1.0%
n_episode :5780, score : 60.5, n_buffer : 50000, eps : 1.0%
n_episode :5800, score : 64.7, n_buffer : 50000, eps : 1.0%
n_episode :5820, score : 67.8, n_buffer : 50000, eps : 1.0%
n_episode :5840, score : 77.5, n_buffer : 50000, eps : 1.0%
```

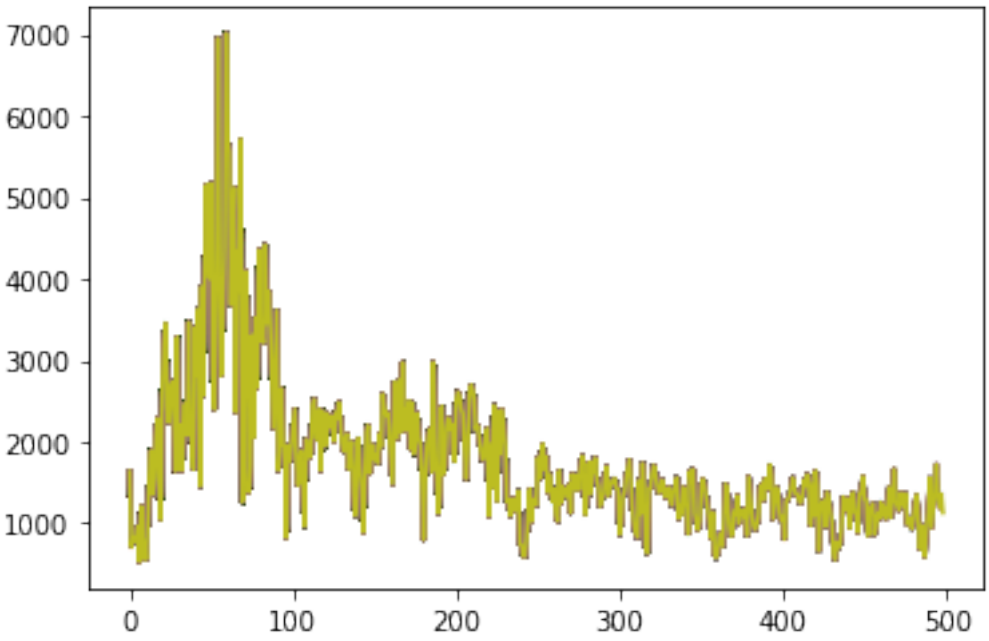
```
n_episode :5860, score : 84.8, n_buffer : 50000, eps : 1.0%
n_episode :5880, score : 67.0, n_buffer : 50000, eps : 1.0%
n_episode :5900, score : 75.5, n_buffer : 50000, eps : 1.0%
n_episode :5920, score : 74.3, n_buffer : 50000, eps : 1.0%
n_episode :5940, score : 74.6, n_buffer : 50000, eps : 1.0%
n_episode :5960, score : 77.5, n_buffer : 50000, eps : 1.0%
n_episode :5980, score : 71.8, n_buffer : 50000, eps : 1.0%
n_episode :6000, score : 71.0, n_buffer : 50000, eps : 1.0%
n_episode :6020, score : 43.5, n_buffer : 50000, eps : 1.0%
n_episode :6040, score : 51.0, n_buffer : 50000, eps : 1.0%
n_episode :6060, score : 67.0, n_buffer : 50000, eps : 1.0%
n_episode :6080, score : 68.8, n_buffer : 50000, eps : 1.0%
n_episode :6100, score : 77.8, n_buffer : 50000, eps : 1.0%
n_episode :6120, score : 83.1, n_buffer : 50000, eps : 1.0%
n_episode :6140, score : 88.9, n_buffer : 50000, eps : 1.0%
n_episode :6160, score : 71.8, n_buffer : 50000, eps : 1.0%
n_episode :6180, score : 57.0, n_buffer : 50000, eps : 1.0%
n_episode :6200, score : 48.5, n_buffer : 50000, eps : 1.0%
n_episode :6220, score : 43.9, n_buffer : 50000, eps : 1.0%
n_episode :6240, score : 41.5, n_buffer : 50000, eps : 1.0%
n_episode :6260, score : 76.2, n_buffer : 50000, eps : 1.0%
n_episode :6280, score : 56.0, n_buffer : 50000, eps : 1.0%
n_episode :6300, score : 86.7, n_buffer : 50000, eps : 1.0%
n_episode :6320, score : 71.9, n_buffer : 50000, eps : 1.0%
n_episode :6340, score : 36.2, n_buffer : 50000, eps : 1.0%
n_episode :6360, score : 31.9, n_buffer : 50000, eps : 1.0%
n_episode :6380, score : 71.4, n_buffer : 50000, eps : 1.0%
n_episode :6400, score : 71.5, n_buffer : 50000, eps : 1.0%
n_episode :6420, score : 81.2, n_buffer : 50000, eps : 1.0%
n_episode :6440, score : 85.5, n_buffer : 50000, eps : 1.0%
n_episode :6460, score : 79.5, n_buffer : 50000, eps : 1.0%
n_episode :6480, score : 73.7, n_buffer : 50000, eps : 1.0%
n_episode :6500, score : 69.0, n_buffer : 50000, eps : 1.0%
n_episode :6520, score : 69.1, n_buffer : 50000, eps : 1.0%
n_episode :6540, score : 76.4, n_buffer : 50000, eps : 1.0%
n_episode :6560, score : 72.6, n_buffer : 50000, eps : 1.0%
n_episode :6580, score : 66.0, n_buffer : 50000, eps : 1.0%
n_episode :6600, score : 66.7, n_buffer : 50000, eps : 1.0%
n_episode :6620, score : 72.0, n_buffer : 50000, eps : 1.0%
n_episode :6640, score : 65.4, n_buffer : 50000, eps : 1.0%
n_episode :6660, score : 61.3, n_buffer : 50000, eps : 1.0%
n_episode :6680, score : 71.0, n_buffer : 50000, eps : 1.0%
n_episode :6700, score : 72.0, n_buffer : 50000, eps : 1.0%
n_episode :6720, score : 77.8, n_buffer : 50000, eps : 1.0%
n_episode :6740, score : 53.1, n_buffer : 50000, eps : 1.0%
n_episode :6760, score : 59.9, n_buffer : 50000, eps : 1.0%
n_episode :6780, score : 55.4, n_buffer : 50000, eps : 1.0%
n_episode :6800, score : 72.2, n_buffer : 50000, eps : 1.0%
```

```
n_episode :6820, score : 62.1, n_buffer : 50000, eps : 1.0%
n_episode :6840, score : 60.0, n_buffer : 50000, eps : 1.0%
n_episode :6860, score : 43.7, n_buffer : 50000, eps : 1.0%
n_episode :6880, score : 81.8, n_buffer : 50000, eps : 1.0%
n_episode :6900, score : 75.1, n_buffer : 50000, eps : 1.0%
n_episode :6920, score : 82.9, n_buffer : 50000, eps : 1.0%
n_episode :6940, score : 56.1, n_buffer : 50000, eps : 1.0%
n_episode :6960, score : 51.2, n_buffer : 50000, eps : 1.0%
n_episode :6980, score : 46.0, n_buffer : 50000, eps : 1.0%
n_episode :7000, score : 51.6, n_buffer : 50000, eps : 1.0%
n_episode :7020, score : 73.2, n_buffer : 50000, eps : 1.0%
n_episode :7040, score : 77.2, n_buffer : 50000, eps : 1.0%
n_episode :7060, score : 72.8, n_buffer : 50000, eps : 1.0%
n_episode :7080, score : 65.8, n_buffer : 50000, eps : 1.0%
n_episode :7100, score : 59.9, n_buffer : 50000, eps : 1.0%
n_episode :7120, score : 51.2, n_buffer : 50000, eps : 1.0%
n_episode :7140, score : 40.9, n_buffer : 50000, eps : 1.0%
n_episode :7160, score : 56.7, n_buffer : 50000, eps : 1.0%
n_episode :7180, score : 31.6, n_buffer : 50000, eps : 1.0%
n_episode :7200, score : 28.9, n_buffer : 50000, eps : 1.0%
n_episode :7220, score : 31.9, n_buffer : 50000, eps : 1.0%
n_episode :7240, score : 42.7, n_buffer : 50000, eps : 1.0%
n_episode :7260, score : 43.9, n_buffer : 50000, eps : 1.0%
n_episode :7280, score : 36.0, n_buffer : 50000, eps : 1.0%
n_episode :7300, score : 53.1, n_buffer : 50000, eps : 1.0%
n_episode :7320, score : 74.0, n_buffer : 50000, eps : 1.0%
n_episode :7340, score : 68.4, n_buffer : 50000, eps : 1.0%
n_episode :7360, score : 49.4, n_buffer : 50000, eps : 1.0%
n_episode :7380, score : 42.4, n_buffer : 50000, eps : 1.0%
n_episode :7400, score : 42.6, n_buffer : 50000, eps : 1.0%
n_episode :7420, score : 57.1, n_buffer : 50000, eps : 1.0%
n_episode :7440, score : 55.2, n_buffer : 50000, eps : 1.0%
n_episode :7460, score : 67.1, n_buffer : 50000, eps : 1.0%
n_episode :7480, score : 50.0, n_buffer : 50000, eps : 1.0%
n_episode :7500, score : 58.0, n_buffer : 50000, eps : 1.0%
n_episode :7520, score : 56.4, n_buffer : 50000, eps : 1.0%
n_episode :7540, score : 54.4, n_buffer : 50000, eps : 1.0%
n_episode :7560, score : 59.0, n_buffer : 50000, eps : 1.0%
n_episode :7580, score : 42.5, n_buffer : 50000, eps : 1.0%
n_episode :7600, score : 78.7, n_buffer : 50000, eps : 1.0%
n_episode :7620, score : 66.3, n_buffer : 50000, eps : 1.0%
n_episode :7640, score : 55.7, n_buffer : 50000, eps : 1.0%
n_episode :7660, score : 48.3, n_buffer : 50000, eps : 1.0%
n_episode :7680, score : 46.2, n_buffer : 50000, eps : 1.0%
n_episode :7700, score : 49.6, n_buffer : 50000, eps : 1.0%
n_episode :7720, score : 53.7, n_buffer : 50000, eps : 1.0%
n_episode :7740, score : 71.5, n_buffer : 50000, eps : 1.0%
n_episode :7760, score : 73.8, n_buffer : 50000, eps : 1.0%
```

```
n_episode :7780, score : 64.2, n_buffer : 50000, eps : 1.0%
n_episode :7800, score : 77.5, n_buffer : 50000, eps : 1.0%
n_episode :7820, score : 75.3, n_buffer : 50000, eps : 1.0%
n_episode :7840, score : 71.2, n_buffer : 50000, eps : 1.0%
n_episode :7860, score : 85.8, n_buffer : 50000, eps : 1.0%
n_episode :7880, score : 79.3, n_buffer : 50000, eps : 1.0%
n_episode :7900, score : 52.8, n_buffer : 50000, eps : 1.0%
n_episode :7920, score : 63.1, n_buffer : 50000, eps : 1.0%
n_episode :7940, score : 72.0, n_buffer : 50000, eps : 1.0%
n_episode :7960, score : 69.0, n_buffer : 50000, eps : 1.0%
n_episode :7980, score : 56.6, n_buffer : 50000, eps : 1.0%
n_episode :8000, score : 51.9, n_buffer : 50000, eps : 1.0%
n_episode :8020, score : 53.6, n_buffer : 50000, eps : 1.0%
n_episode :8040, score : 40.5, n_buffer : 50000, eps : 1.0%
n_episode :8060, score : 63.8, n_buffer : 50000, eps : 1.0%
n_episode :8080, score : 64.5, n_buffer : 50000, eps : 1.0%
n_episode :8100, score : 66.9, n_buffer : 50000, eps : 1.0%
n_episode :8120, score : 71.7, n_buffer : 50000, eps : 1.0%
n_episode :8140, score : 77.7, n_buffer : 50000, eps : 1.0%
n_episode :8160, score : 71.7, n_buffer : 50000, eps : 1.0%
n_episode :8180, score : 68.0, n_buffer : 50000, eps : 1.0%
n_episode :8200, score : 67.5, n_buffer : 50000, eps : 1.0%
n_episode :8220, score : 63.5, n_buffer : 50000, eps : 1.0%
n_episode :8240, score : 62.5, n_buffer : 50000, eps : 1.0%
n_episode :8260, score : 67.5, n_buffer : 50000, eps : 1.0%
n_episode :8280, score : 76.3, n_buffer : 50000, eps : 1.0%
n_episode :8300, score : 72.8, n_buffer : 50000, eps : 1.0%
n_episode :8320, score : 79.8, n_buffer : 50000, eps : 1.0%
n_episode :8340, score : 76.7, n_buffer : 50000, eps : 1.0%
n_episode :8360, score : 48.9, n_buffer : 50000, eps : 1.0%
n_episode :8380, score : 73.5, n_buffer : 50000, eps : 1.0%
n_episode :8400, score : 54.6, n_buffer : 50000, eps : 1.0%
n_episode :8420, score : 82.2, n_buffer : 50000, eps : 1.0%
n_episode :8440, score : 73.2, n_buffer : 50000, eps : 1.0%
n_episode :8460, score : 33.2, n_buffer : 50000, eps : 1.0%
n_episode :8480, score : 60.4, n_buffer : 50000, eps : 1.0%
n_episode :8500, score : 62.2, n_buffer : 50000, eps : 1.0%
n_episode :8520, score : 63.6, n_buffer : 50000, eps : 1.0%
n_episode :8540, score : 48.1, n_buffer : 50000, eps : 1.0%
n_episode :8560, score : 69.0, n_buffer : 50000, eps : 1.0%
n_episode :8580, score : 64.3, n_buffer : 50000, eps : 1.0%
n_episode :8600, score : 57.4, n_buffer : 50000, eps : 1.0%
n_episode :8620, score : 50.4, n_buffer : 50000, eps : 1.0%
n_episode :8640, score : 31.1, n_buffer : 50000, eps : 1.0%
n_episode :8660, score : 27.8, n_buffer : 50000, eps : 1.0%
n_episode :8680, score : 38.2, n_buffer : 50000, eps : 1.0%
n_episode :8700, score : 35.1, n_buffer : 50000, eps : 1.0%
n_episode :8720, score : 37.6, n_buffer : 50000, eps : 1.0%
```

```
n_episode :8740, score : 48.5, n_buffer : 50000, eps : 1.0%
n_episode :8760, score : 66.1, n_buffer : 50000, eps : 1.0%
n_episode :8780, score : 57.9, n_buffer : 50000, eps : 1.0%
n_episode :8800, score : 64.6, n_buffer : 50000, eps : 1.0%
n_episode :8820, score : 65.0, n_buffer : 50000, eps : 1.0%
n_episode :8840, score : 47.1, n_buffer : 50000, eps : 1.0%
n_episode :8860, score : 59.6, n_buffer : 50000, eps : 1.0%
n_episode :8880, score : 69.0, n_buffer : 50000, eps : 1.0%
n_episode :8900, score : 57.4, n_buffer : 50000, eps : 1.0%
n_episode :8920, score : 56.2, n_buffer : 50000, eps : 1.0%
n_episode :8940, score : 44.4, n_buffer : 50000, eps : 1.0%
n_episode :8960, score : 68.3, n_buffer : 50000, eps : 1.0%
n_episode :8980, score : 68.8, n_buffer : 50000, eps : 1.0%
n_episode :9000, score : 78.8, n_buffer : 50000, eps : 1.0%
n_episode :9020, score : 64.9, n_buffer : 50000, eps : 1.0%
n_episode :9040, score : 64.1, n_buffer : 50000, eps : 1.0%
n_episode :9060, score : 42.4, n_buffer : 50000, eps : 1.0%
n_episode :9080, score : 57.4, n_buffer : 50000, eps : 1.0%
n_episode :9100, score : 60.1, n_buffer : 50000, eps : 1.0%
n_episode :9120, score : 62.0, n_buffer : 50000, eps : 1.0%
n_episode :9140, score : 43.3, n_buffer : 50000, eps : 1.0%
n_episode :9160, score : 47.4, n_buffer : 50000, eps : 1.0%
n_episode :9180, score : 56.0, n_buffer : 50000, eps : 1.0%
n_episode :9200, score : 53.0, n_buffer : 50000, eps : 1.0%
n_episode :9220, score : 62.9, n_buffer : 50000, eps : 1.0%
n_episode :9240, score : 54.7, n_buffer : 50000, eps : 1.0%
n_episode :9260, score : 60.0, n_buffer : 50000, eps : 1.0%
n_episode :9280, score : 52.9, n_buffer : 50000, eps : 1.0%
n_episode :9300, score : 59.0, n_buffer : 50000, eps : 1.0%
n_episode :9320, score : 72.0, n_buffer : 50000, eps : 1.0%
n_episode :9340, score : 53.7, n_buffer : 50000, eps : 1.0%
n_episode :9360, score : 62.9, n_buffer : 50000, eps : 1.0%
n_episode :9380, score : 83.0, n_buffer : 50000, eps : 1.0%
n_episode :9400, score : 64.2, n_buffer : 50000, eps : 1.0%
n_episode :9420, score : 61.2, n_buffer : 50000, eps : 1.0%
n_episode :9440, score : 58.0, n_buffer : 50000, eps : 1.0%
n_episode :9460, score : 68.8, n_buffer : 50000, eps : 1.0%
n_episode :9480, score : 66.2, n_buffer : 50000, eps : 1.0%
n_episode :9500, score : 60.4, n_buffer : 50000, eps : 1.0%
n_episode :9520, score : 68.2, n_buffer : 50000, eps : 1.0%
n_episode :9540, score : 49.5, n_buffer : 50000, eps : 1.0%
n_episode :9560, score : 52.7, n_buffer : 50000, eps : 1.0%
n_episode :9580, score : 53.0, n_buffer : 50000, eps : 1.0%
n_episode :9600, score : 46.8, n_buffer : 50000, eps : 1.0%
n_episode :9620, score : 52.8, n_buffer : 50000, eps : 1.0%
n_episode :9640, score : 63.0, n_buffer : 50000, eps : 1.0%
n_episode :9660, score : 67.5, n_buffer : 50000, eps : 1.0%
n_episode :9680, score : 49.8, n_buffer : 50000, eps : 1.0%
```

```
n_episode :9700, score : 34.2, n_buffer : 50000, eps : 1.0%
n_episode :9720, score : 48.6, n_buffer : 50000, eps : 1.0%
n_episode :9740, score : 34.6, n_buffer : 50000, eps : 1.0%
n_episode :9760, score : 29.4, n_buffer : 50000, eps : 1.0%
n_episode :9780, score : 46.7, n_buffer : 50000, eps : 1.0%
n_episode :9800, score : 57.5, n_buffer : 50000, eps : 1.0%
n_episode :9820, score : 77.9, n_buffer : 50000, eps : 1.0%
n_episode :9840, score : 47.5, n_buffer : 50000, eps : 1.0%
n_episode :9860, score : 58.2, n_buffer : 50000, eps : 1.0%
n_episode :9880, score : 69.3, n_buffer : 50000, eps : 1.0%
n_episode :9900, score : 86.1, n_buffer : 50000, eps : 1.0%
n_episode :9920, score : 66.4, n_buffer : 50000, eps : 1.0%
n_episode :9940, score : 59.4, n_buffer : 50000, eps : 1.0%
n_episode :9960, score : 67.8, n_buffer : 50000, eps : 1.0%
n_episode :9980, score : 56.5, n_buffer : 50000, eps : 1.0%
```



When we change the gamma from 0.98 to 0.75, we can see the learning decreases significantly.

[18]:
```
#Change gamma from 0.98 to 0.9

#Hyperparameters
learning_rate = 0.0005
gamma         = 0.9
buffer_limit  = 50000
batch_size    = 32
```

```python
if __name__ == '__main__':
    main()
    plt.show()
```

```
n_episode :20, score : 10.8, n_buffer : 215, eps : 7.9%
n_episode :40, score : 9.6, n_buffer : 406, eps : 7.8%
n_episode :60, score : 9.4, n_buffer : 594, eps : 7.7%
n_episode :80, score : 9.9, n_buffer : 793, eps : 7.6%
n_episode :100, score : 9.7, n_buffer : 986, eps : 7.5%
n_episode :120, score : 9.9, n_buffer : 1184, eps : 7.4%
n_episode :140, score : 10.1, n_buffer : 1386, eps : 7.3%
n_episode :160, score : 9.8, n_buffer : 1583, eps : 7.2%
n_episode :180, score : 9.9, n_buffer : 1781, eps : 7.1%
n_episode :200, score : 9.6, n_buffer : 1972, eps : 7.0%
n_episode :220, score : 10.3, n_buffer : 2179, eps : 6.9%
n_episode :240, score : 10.7, n_buffer : 2393, eps : 6.8%
n_episode :260, score : 10.3, n_buffer : 2599, eps : 6.7%
n_episode :280, score : 11.6, n_buffer : 2830, eps : 6.6%
n_episode :300, score : 13.2, n_buffer : 3095, eps : 6.5%
n_episode :320, score : 27.6, n_buffer : 3648, eps : 6.4%
n_episode :340, score : 49.8, n_buffer : 4644, eps : 6.3%
n_episode :360, score : 141.2, n_buffer : 7467, eps : 6.2%
n_episode :380, score : 164.7, n_buffer : 10760, eps : 6.1%
n_episode :400, score : 179.1, n_buffer : 14342, eps : 6.0%
n_episode :420, score : 161.0, n_buffer : 17562, eps : 5.9%
n_episode :440, score : 229.9, n_buffer : 22161, eps : 5.8%
n_episode :460, score : 282.4, n_buffer : 27810, eps : 5.7%
n_episode :480, score : 295.1, n_buffer : 33712, eps : 5.6%
n_episode :500, score : 189.3, n_buffer : 37499, eps : 5.5%
n_episode :520, score : 140.6, n_buffer : 40310, eps : 5.4%
n_episode :540, score : 164.8, n_buffer : 43605, eps : 5.3%
n_episode :560, score : 186.6, n_buffer : 47336, eps : 5.2%
n_episode :580, score : 173.9, n_buffer : 50000, eps : 5.1%
n_episode :600, score : 233.6, n_buffer : 50000, eps : 5.0%
n_episode :620, score : 300.9, n_buffer : 50000, eps : 4.9%
n_episode :640, score : 248.0, n_buffer : 50000, eps : 4.8%
n_episode :660, score : 196.3, n_buffer : 50000, eps : 4.7%
n_episode :680, score : 215.2, n_buffer : 50000, eps : 4.6%
n_episode :700, score : 229.9, n_buffer : 50000, eps : 4.5%
n_episode :720, score : 287.9, n_buffer : 50000, eps : 4.4%
n_episode :740, score : 210.2, n_buffer : 50000, eps : 4.3%
n_episode :760, score : 178.4, n_buffer : 50000, eps : 4.2%
n_episode :780, score : 202.8, n_buffer : 50000, eps : 4.1%
n_episode :800, score : 139.6, n_buffer : 50000, eps : 4.0%
n_episode :820, score : 68.5, n_buffer : 50000, eps : 3.9%
n_episode :840, score : 145.6, n_buffer : 50000, eps : 3.8%
n_episode :860, score : 105.2, n_buffer : 50000, eps : 3.7%
```

```
n_episode :880, score : 174.3, n_buffer : 50000, eps : 3.6%
n_episode :900, score : 141.7, n_buffer : 50000, eps : 3.5%
n_episode :920, score : 104.0, n_buffer : 50000, eps : 3.4%
n_episode :940, score : 178.8, n_buffer : 50000, eps : 3.3%
n_episode :960, score : 192.4, n_buffer : 50000, eps : 3.2%
n_episode :980, score : 244.8, n_buffer : 50000, eps : 3.1%
n_episode :1000, score : 323.8, n_buffer : 50000, eps : 3.0%
n_episode :1020, score : 298.1, n_buffer : 50000, eps : 2.9%
n_episode :1040, score : 168.9, n_buffer : 50000, eps : 2.8%
n_episode :1060, score : 236.0, n_buffer : 50000, eps : 2.7%
n_episode :1080, score : 216.2, n_buffer : 50000, eps : 2.6%
n_episode :1100, score : 189.3, n_buffer : 50000, eps : 2.5%
n_episode :1120, score : 281.9, n_buffer : 50000, eps : 2.4%
n_episode :1140, score : 173.7, n_buffer : 50000, eps : 2.3%
n_episode :1160, score : 191.2, n_buffer : 50000, eps : 2.2%
n_episode :1180, score : 237.8, n_buffer : 50000, eps : 2.1%
n_episode :1200, score : 277.0, n_buffer : 50000, eps : 2.0%
n_episode :1220, score : 161.2, n_buffer : 50000, eps : 1.9%
n_episode :1240, score : 168.8, n_buffer : 50000, eps : 1.8%
n_episode :1260, score : 208.2, n_buffer : 50000, eps : 1.7%
n_episode :1280, score : 192.8, n_buffer : 50000, eps : 1.6%
n_episode :1300, score : 240.8, n_buffer : 50000, eps : 1.5%
n_episode :1320, score : 209.7, n_buffer : 50000, eps : 1.4%
n_episode :1340, score : 170.9, n_buffer : 50000, eps : 1.3%
n_episode :1360, score : 221.8, n_buffer : 50000, eps : 1.2%
n_episode :1380, score : 186.3, n_buffer : 50000, eps : 1.1%
n_episode :1400, score : 212.7, n_buffer : 50000, eps : 1.0%
n_episode :1420, score : 197.9, n_buffer : 50000, eps : 1.0%
n_episode :1440, score : 178.6, n_buffer : 50000, eps : 1.0%
n_episode :1460, score : 119.1, n_buffer : 50000, eps : 1.0%
n_episode :1480, score : 169.2, n_buffer : 50000, eps : 1.0%
n_episode :1500, score : 88.1, n_buffer : 50000, eps : 1.0%
n_episode :1520, score : 200.2, n_buffer : 50000, eps : 1.0%
n_episode :1540, score : 135.4, n_buffer : 50000, eps : 1.0%
n_episode :1560, score : 108.5, n_buffer : 50000, eps : 1.0%
n_episode :1580, score : 211.8, n_buffer : 50000, eps : 1.0%
n_episode :1600, score : 115.2, n_buffer : 50000, eps : 1.0%
n_episode :1620, score : 228.1, n_buffer : 50000, eps : 1.0%
n_episode :1640, score : 173.4, n_buffer : 50000, eps : 1.0%
n_episode :1660, score : 151.1, n_buffer : 50000, eps : 1.0%
n_episode :1680, score : 175.8, n_buffer : 50000, eps : 1.0%
n_episode :1700, score : 199.1, n_buffer : 50000, eps : 1.0%
n_episode :1720, score : 200.6, n_buffer : 50000, eps : 1.0%
n_episode :1740, score : 139.0, n_buffer : 50000, eps : 1.0%
n_episode :1760, score : 176.3, n_buffer : 50000, eps : 1.0%
n_episode :1780, score : 170.8, n_buffer : 50000, eps : 1.0%
n_episode :1800, score : 199.3, n_buffer : 50000, eps : 1.0%
n_episode :1820, score : 119.8, n_buffer : 50000, eps : 1.0%
```

```
n_episode :1840, score : 251.6, n_buffer : 50000, eps : 1.0%
n_episode :1860, score : 219.8, n_buffer : 50000, eps : 1.0%
n_episode :1880, score : 187.8, n_buffer : 50000, eps : 1.0%
n_episode :1900, score : 268.0, n_buffer : 50000, eps : 1.0%
n_episode :1920, score : 249.0, n_buffer : 50000, eps : 1.0%
n_episode :1940, score : 228.2, n_buffer : 50000, eps : 1.0%
n_episode :1960, score : 309.9, n_buffer : 50000, eps : 1.0%
n_episode :1980, score : 189.0, n_buffer : 50000, eps : 1.0%
n_episode :2000, score : 239.3, n_buffer : 50000, eps : 1.0%
n_episode :2020, score : 254.3, n_buffer : 50000, eps : 1.0%
n_episode :2040, score : 257.6, n_buffer : 50000, eps : 1.0%
n_episode :2060, score : 215.1, n_buffer : 50000, eps : 1.0%
n_episode :2080, score : 235.0, n_buffer : 50000, eps : 1.0%
n_episode :2100, score : 244.2, n_buffer : 50000, eps : 1.0%
n_episode :2120, score : 216.8, n_buffer : 50000, eps : 1.0%
n_episode :2140, score : 175.2, n_buffer : 50000, eps : 1.0%
n_episode :2160, score : 180.0, n_buffer : 50000, eps : 1.0%
n_episode :2180, score : 201.8, n_buffer : 50000, eps : 1.0%
n_episode :2200, score : 227.6, n_buffer : 50000, eps : 1.0%
n_episode :2220, score : 282.7, n_buffer : 50000, eps : 1.0%
n_episode :2240, score : 200.2, n_buffer : 50000, eps : 1.0%
n_episode :2260, score : 207.7, n_buffer : 50000, eps : 1.0%
n_episode :2280, score : 223.7, n_buffer : 50000, eps : 1.0%
n_episode :2300, score : 255.4, n_buffer : 50000, eps : 1.0%
n_episode :2320, score : 304.9, n_buffer : 50000, eps : 1.0%
n_episode :2340, score : 159.8, n_buffer : 50000, eps : 1.0%
n_episode :2360, score : 202.3, n_buffer : 50000, eps : 1.0%
n_episode :2380, score : 219.1, n_buffer : 50000, eps : 1.0%
n_episode :2400, score : 219.3, n_buffer : 50000, eps : 1.0%
n_episode :2420, score : 216.9, n_buffer : 50000, eps : 1.0%
n_episode :2440, score : 235.2, n_buffer : 50000, eps : 1.0%
n_episode :2460, score : 228.2, n_buffer : 50000, eps : 1.0%
n_episode :2480, score : 217.3, n_buffer : 50000, eps : 1.0%
n_episode :2500, score : 335.4, n_buffer : 50000, eps : 1.0%
n_episode :2520, score : 232.9, n_buffer : 50000, eps : 1.0%
n_episode :2540, score : 125.9, n_buffer : 50000, eps : 1.0%
n_episode :2560, score : 121.3, n_buffer : 50000, eps : 1.0%
n_episode :2580, score : 180.9, n_buffer : 50000, eps : 1.0%
n_episode :2600, score : 291.9, n_buffer : 50000, eps : 1.0%
n_episode :2620, score : 212.9, n_buffer : 50000, eps : 1.0%
n_episode :2640, score : 229.1, n_buffer : 50000, eps : 1.0%
n_episode :2660, score : 248.0, n_buffer : 50000, eps : 1.0%
n_episode :2680, score : 217.3, n_buffer : 50000, eps : 1.0%
n_episode :2700, score : 207.8, n_buffer : 50000, eps : 1.0%
n_episode :2720, score : 280.6, n_buffer : 50000, eps : 1.0%
n_episode :2740, score : 188.5, n_buffer : 50000, eps : 1.0%
n_episode :2760, score : 159.7, n_buffer : 50000, eps : 1.0%
n_episode :2780, score : 136.3, n_buffer : 50000, eps : 1.0%
```

```
n_episode :2800, score : 156.7, n_buffer : 50000, eps : 1.0%
n_episode :2820, score : 185.3, n_buffer : 50000, eps : 1.0%
n_episode :2840, score : 201.4, n_buffer : 50000, eps : 1.0%
n_episode :2860, score : 242.8, n_buffer : 50000, eps : 1.0%
n_episode :2880, score : 194.8, n_buffer : 50000, eps : 1.0%
n_episode :2900, score : 258.0, n_buffer : 50000, eps : 1.0%
n_episode :2920, score : 293.1, n_buffer : 50000, eps : 1.0%
n_episode :2940, score : 171.2, n_buffer : 50000, eps : 1.0%
n_episode :2960, score : 236.6, n_buffer : 50000, eps : 1.0%
n_episode :2980, score : 231.2, n_buffer : 50000, eps : 1.0%
n_episode :3000, score : 160.2, n_buffer : 50000, eps : 1.0%
n_episode :3020, score : 151.9, n_buffer : 50000, eps : 1.0%
n_episode :3040, score : 178.8, n_buffer : 50000, eps : 1.0%
n_episode :3060, score : 178.8, n_buffer : 50000, eps : 1.0%
n_episode :3080, score : 141.8, n_buffer : 50000, eps : 1.0%
n_episode :3100, score : 153.3, n_buffer : 50000, eps : 1.0%
n_episode :3120, score : 167.9, n_buffer : 50000, eps : 1.0%
n_episode :3140, score : 138.8, n_buffer : 50000, eps : 1.0%
n_episode :3160, score : 205.4, n_buffer : 50000, eps : 1.0%
n_episode :3180, score : 193.2, n_buffer : 50000, eps : 1.0%
n_episode :3200, score : 173.2, n_buffer : 50000, eps : 1.0%
n_episode :3220, score : 199.2, n_buffer : 50000, eps : 1.0%
n_episode :3240, score : 134.1, n_buffer : 50000, eps : 1.0%
n_episode :3260, score : 203.5, n_buffer : 50000, eps : 1.0%
n_episode :3280, score : 277.9, n_buffer : 50000, eps : 1.0%
n_episode :3300, score : 180.9, n_buffer : 50000, eps : 1.0%
n_episode :3320, score : 155.5, n_buffer : 50000, eps : 1.0%
n_episode :3340, score : 183.6, n_buffer : 50000, eps : 1.0%
n_episode :3360, score : 133.4, n_buffer : 50000, eps : 1.0%
n_episode :3380, score : 173.0, n_buffer : 50000, eps : 1.0%
n_episode :3400, score : 156.2, n_buffer : 50000, eps : 1.0%
n_episode :3420, score : 171.9, n_buffer : 50000, eps : 1.0%
n_episode :3440, score : 216.7, n_buffer : 50000, eps : 1.0%
n_episode :3460, score : 181.7, n_buffer : 50000, eps : 1.0%
n_episode :3480, score : 260.5, n_buffer : 50000, eps : 1.0%
n_episode :3500, score : 171.2, n_buffer : 50000, eps : 1.0%
n_episode :3520, score : 137.8, n_buffer : 50000, eps : 1.0%
n_episode :3540, score : 156.7, n_buffer : 50000, eps : 1.0%
n_episode :3560, score : 147.6, n_buffer : 50000, eps : 1.0%
n_episode :3580, score : 192.6, n_buffer : 50000, eps : 1.0%
n_episode :3600, score : 187.0, n_buffer : 50000, eps : 1.0%
n_episode :3620, score : 205.0, n_buffer : 50000, eps : 1.0%
n_episode :3640, score : 203.2, n_buffer : 50000, eps : 1.0%
n_episode :3660, score : 163.2, n_buffer : 50000, eps : 1.0%
n_episode :3680, score : 245.4, n_buffer : 50000, eps : 1.0%
n_episode :3700, score : 246.2, n_buffer : 50000, eps : 1.0%
n_episode :3720, score : 163.7, n_buffer : 50000, eps : 1.0%
n_episode :3740, score : 210.6, n_buffer : 50000, eps : 1.0%
```

```
n_episode :3760, score : 177.2, n_buffer : 50000, eps : 1.0%
n_episode :3780, score : 197.2, n_buffer : 50000, eps : 1.0%
n_episode :3800, score : 164.6, n_buffer : 50000, eps : 1.0%
n_episode :3820, score : 166.8, n_buffer : 50000, eps : 1.0%
n_episode :3840, score : 145.4, n_buffer : 50000, eps : 1.0%
n_episode :3860, score : 276.4, n_buffer : 50000, eps : 1.0%
n_episode :3880, score : 214.7, n_buffer : 50000, eps : 1.0%
n_episode :3900, score : 258.1, n_buffer : 50000, eps : 1.0%
n_episode :3920, score : 230.1, n_buffer : 50000, eps : 1.0%
n_episode :3940, score : 247.3, n_buffer : 50000, eps : 1.0%
n_episode :3960, score : 259.0, n_buffer : 50000, eps : 1.0%
n_episode :3980, score : 235.8, n_buffer : 50000, eps : 1.0%
n_episode :4000, score : 276.1, n_buffer : 50000, eps : 1.0%
n_episode :4020, score : 257.8, n_buffer : 50000, eps : 1.0%
n_episode :4040, score : 302.6, n_buffer : 50000, eps : 1.0%
n_episode :4060, score : 279.4, n_buffer : 50000, eps : 1.0%
n_episode :4080, score : 283.0, n_buffer : 50000, eps : 1.0%
n_episode :4100, score : 220.3, n_buffer : 50000, eps : 1.0%
n_episode :4120, score : 159.1, n_buffer : 50000, eps : 1.0%
n_episode :4140, score : 183.7, n_buffer : 50000, eps : 1.0%
n_episode :4160, score : 264.8, n_buffer : 50000, eps : 1.0%
n_episode :4180, score : 187.4, n_buffer : 50000, eps : 1.0%
n_episode :4200, score : 211.4, n_buffer : 50000, eps : 1.0%
n_episode :4220, score : 261.6, n_buffer : 50000, eps : 1.0%
n_episode :4240, score : 266.9, n_buffer : 50000, eps : 1.0%
n_episode :4260, score : 264.1, n_buffer : 50000, eps : 1.0%
n_episode :4280, score : 226.1, n_buffer : 50000, eps : 1.0%
n_episode :4300, score : 237.9, n_buffer : 50000, eps : 1.0%
n_episode :4320, score : 218.1, n_buffer : 50000, eps : 1.0%
n_episode :4340, score : 186.9, n_buffer : 50000, eps : 1.0%
n_episode :4360, score : 265.8, n_buffer : 50000, eps : 1.0%
n_episode :4380, score : 145.6, n_buffer : 50000, eps : 1.0%
n_episode :4400, score : 164.4, n_buffer : 50000, eps : 1.0%
n_episode :4420, score : 115.0, n_buffer : 50000, eps : 1.0%
n_episode :4440, score : 141.7, n_buffer : 50000, eps : 1.0%
n_episode :4460, score : 161.0, n_buffer : 50000, eps : 1.0%
n_episode :4480, score : 184.8, n_buffer : 50000, eps : 1.0%
n_episode :4500, score : 220.2, n_buffer : 50000, eps : 1.0%
n_episode :4520, score : 174.9, n_buffer : 50000, eps : 1.0%
n_episode :4540, score : 169.8, n_buffer : 50000, eps : 1.0%
n_episode :4560, score : 148.2, n_buffer : 50000, eps : 1.0%
n_episode :4580, score : 185.7, n_buffer : 50000, eps : 1.0%
n_episode :4600, score : 171.1, n_buffer : 50000, eps : 1.0%
n_episode :4620, score : 220.2, n_buffer : 50000, eps : 1.0%
n_episode :4640, score : 185.9, n_buffer : 50000, eps : 1.0%
n_episode :4660, score : 140.2, n_buffer : 50000, eps : 1.0%
n_episode :4680, score : 115.2, n_buffer : 50000, eps : 1.0%
n_episode :4700, score : 134.2, n_buffer : 50000, eps : 1.0%
```

```
n_episode :4720, score : 117.5, n_buffer : 50000, eps : 1.0%
n_episode :4740, score : 163.1, n_buffer : 50000, eps : 1.0%
n_episode :4760, score : 195.2, n_buffer : 50000, eps : 1.0%
n_episode :4780, score : 147.2, n_buffer : 50000, eps : 1.0%
n_episode :4800, score : 134.9, n_buffer : 50000, eps : 1.0%
n_episode :4820, score : 114.2, n_buffer : 50000, eps : 1.0%
n_episode :4840, score : 111.7, n_buffer : 50000, eps : 1.0%
n_episode :4860, score : 174.1, n_buffer : 50000, eps : 1.0%
n_episode :4880, score : 178.8, n_buffer : 50000, eps : 1.0%
n_episode :4900, score : 156.4, n_buffer : 50000, eps : 1.0%
n_episode :4920, score : 138.3, n_buffer : 50000, eps : 1.0%
n_episode :4940, score : 127.2, n_buffer : 50000, eps : 1.0%
n_episode :4960, score : 164.7, n_buffer : 50000, eps : 1.0%
n_episode :4980, score : 177.2, n_buffer : 50000, eps : 1.0%
n_episode :5000, score : 193.7, n_buffer : 50000, eps : 1.0%
n_episode :5020, score : 185.2, n_buffer : 50000, eps : 1.0%
n_episode :5040, score : 175.7, n_buffer : 50000, eps : 1.0%
n_episode :5060, score : 154.0, n_buffer : 50000, eps : 1.0%
n_episode :5080, score : 174.1, n_buffer : 50000, eps : 1.0%
n_episode :5100, score : 174.7, n_buffer : 50000, eps : 1.0%
n_episode :5120, score : 226.8, n_buffer : 50000, eps : 1.0%
n_episode :5140, score : 187.0, n_buffer : 50000, eps : 1.0%
n_episode :5160, score : 218.3, n_buffer : 50000, eps : 1.0%
n_episode :5180, score : 209.9, n_buffer : 50000, eps : 1.0%
n_episode :5200, score : 197.0, n_buffer : 50000, eps : 1.0%
n_episode :5220, score : 219.6, n_buffer : 50000, eps : 1.0%
n_episode :5240, score : 205.2, n_buffer : 50000, eps : 1.0%
n_episode :5260, score : 186.2, n_buffer : 50000, eps : 1.0%
n_episode :5280, score : 173.7, n_buffer : 50000, eps : 1.0%
n_episode :5300, score : 178.8, n_buffer : 50000, eps : 1.0%
n_episode :5320, score : 165.4, n_buffer : 50000, eps : 1.0%
n_episode :5340, score : 146.3, n_buffer : 50000, eps : 1.0%
n_episode :5360, score : 128.4, n_buffer : 50000, eps : 1.0%
n_episode :5380, score : 247.0, n_buffer : 50000, eps : 1.0%
n_episode :5400, score : 195.1, n_buffer : 50000, eps : 1.0%
n_episode :5420, score : 151.7, n_buffer : 50000, eps : 1.0%
n_episode :5440, score : 111.1, n_buffer : 50000, eps : 1.0%
n_episode :5460, score : 133.1, n_buffer : 50000, eps : 1.0%
n_episode :5480, score : 147.0, n_buffer : 50000, eps : 1.0%
n_episode :5500, score : 234.8, n_buffer : 50000, eps : 1.0%
n_episode :5520, score : 182.3, n_buffer : 50000, eps : 1.0%
n_episode :5540, score : 152.7, n_buffer : 50000, eps : 1.0%
n_episode :5560, score : 173.8, n_buffer : 50000, eps : 1.0%
n_episode :5580, score : 185.0, n_buffer : 50000, eps : 1.0%
n_episode :5600, score : 179.6, n_buffer : 50000, eps : 1.0%
n_episode :5620, score : 142.7, n_buffer : 50000, eps : 1.0%
n_episode :5640, score : 143.3, n_buffer : 50000, eps : 1.0%
n_episode :5660, score : 110.6, n_buffer : 50000, eps : 1.0%
```

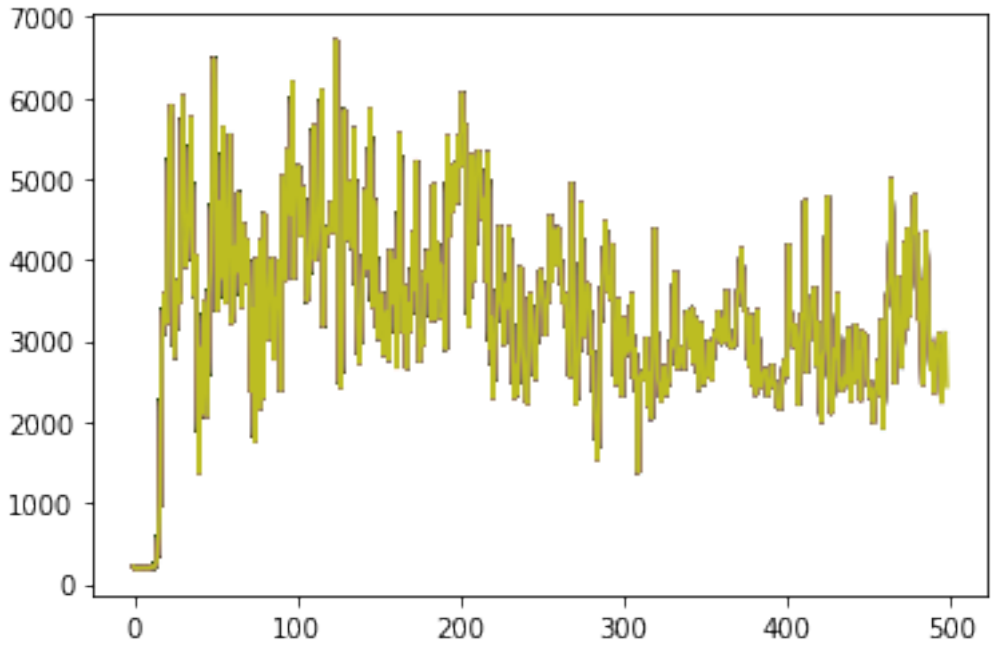
```
n_episode :5680, score : 97.2, n_buffer : 50000, eps : 1.0%
n_episode :5700, score : 76.8, n_buffer : 50000, eps : 1.0%
n_episode :5720, score : 107.2, n_buffer : 50000, eps : 1.0%
n_episode :5740, score : 169.9, n_buffer : 50000, eps : 1.0%
n_episode :5760, score : 189.0, n_buffer : 50000, eps : 1.0%
n_episode :5780, score : 200.6, n_buffer : 50000, eps : 1.0%
n_episode :5800, score : 223.7, n_buffer : 50000, eps : 1.0%
n_episode :5820, score : 180.8, n_buffer : 50000, eps : 1.0%
n_episode :5840, score : 189.3, n_buffer : 50000, eps : 1.0%
n_episode :5860, score : 176.1, n_buffer : 50000, eps : 1.0%
n_episode :5880, score : 209.4, n_buffer : 50000, eps : 1.0%
n_episode :5900, score : 157.4, n_buffer : 50000, eps : 1.0%
n_episode :5920, score : 123.7, n_buffer : 50000, eps : 1.0%
n_episode :5940, score : 153.9, n_buffer : 50000, eps : 1.0%
n_episode :5960, score : 175.4, n_buffer : 50000, eps : 1.0%
n_episode :5980, score : 142.1, n_buffer : 50000, eps : 1.0%
n_episode :6000, score : 116.5, n_buffer : 50000, eps : 1.0%
n_episode :6020, score : 164.2, n_buffer : 50000, eps : 1.0%
n_episode :6040, score : 141.6, n_buffer : 50000, eps : 1.0%
n_episode :6060, score : 150.8, n_buffer : 50000, eps : 1.0%
n_episode :6080, score : 144.2, n_buffer : 50000, eps : 1.0%
n_episode :6100, score : 159.2, n_buffer : 50000, eps : 1.0%
n_episode :6120, score : 178.7, n_buffer : 50000, eps : 1.0%
n_episode :6140, score : 127.8, n_buffer : 50000, eps : 1.0%
n_episode :6160, score : 145.0, n_buffer : 50000, eps : 1.0%
n_episode :6180, score : 117.5, n_buffer : 50000, eps : 1.0%
n_episode :6200, score : 69.2, n_buffer : 50000, eps : 1.0%
n_episode :6220, score : 127.3, n_buffer : 50000, eps : 1.0%
n_episode :6240, score : 129.7, n_buffer : 50000, eps : 1.0%
n_episode :6260, score : 126.1, n_buffer : 50000, eps : 1.0%
n_episode :6280, score : 133.6, n_buffer : 50000, eps : 1.0%
n_episode :6300, score : 151.6, n_buffer : 50000, eps : 1.0%
n_episode :6320, score : 110.5, n_buffer : 50000, eps : 1.0%
n_episode :6340, score : 130.3, n_buffer : 50000, eps : 1.0%
n_episode :6360, score : 102.7, n_buffer : 50000, eps : 1.0%
n_episode :6380, score : 143.2, n_buffer : 50000, eps : 1.0%
n_episode :6400, score : 218.8, n_buffer : 50000, eps : 1.0%
n_episode :6420, score : 162.8, n_buffer : 50000, eps : 1.0%
n_episode :6440, score : 126.5, n_buffer : 50000, eps : 1.0%
n_episode :6460, score : 122.8, n_buffer : 50000, eps : 1.0%
n_episode :6480, score : 112.8, n_buffer : 50000, eps : 1.0%
n_episode :6500, score : 121.4, n_buffer : 50000, eps : 1.0%
n_episode :6520, score : 133.9, n_buffer : 50000, eps : 1.0%
n_episode :6540, score : 117.2, n_buffer : 50000, eps : 1.0%
n_episode :6560, score : 123.9, n_buffer : 50000, eps : 1.0%
n_episode :6580, score : 124.9, n_buffer : 50000, eps : 1.0%
n_episode :6600, score : 149.6, n_buffer : 50000, eps : 1.0%
n_episode :6620, score : 146.4, n_buffer : 50000, eps : 1.0%
```

```
n_episode :6640, score : 191.5, n_buffer : 50000, eps : 1.0%
n_episode :6660, score : 191.7, n_buffer : 50000, eps : 1.0%
n_episode :6680, score : 133.4, n_buffer : 50000, eps : 1.0%
n_episode :6700, score : 142.8, n_buffer : 50000, eps : 1.0%
n_episode :6720, score : 145.9, n_buffer : 50000, eps : 1.0%
n_episode :6740, score : 137.3, n_buffer : 50000, eps : 1.0%
n_episode :6760, score : 133.4, n_buffer : 50000, eps : 1.0%
n_episode :6780, score : 164.7, n_buffer : 50000, eps : 1.0%
n_episode :6800, score : 168.1, n_buffer : 50000, eps : 1.0%
n_episode :6820, score : 154.8, n_buffer : 50000, eps : 1.0%
n_episode :6840, score : 145.8, n_buffer : 50000, eps : 1.0%
n_episode :6860, score : 169.8, n_buffer : 50000, eps : 1.0%
n_episode :6880, score : 136.7, n_buffer : 50000, eps : 1.0%
n_episode :6900, score : 163.6, n_buffer : 50000, eps : 1.0%
n_episode :6920, score : 140.9, n_buffer : 50000, eps : 1.0%
n_episode :6940, score : 120.8, n_buffer : 50000, eps : 1.0%
n_episode :6960, score : 160.8, n_buffer : 50000, eps : 1.0%
n_episode :6980, score : 150.3, n_buffer : 50000, eps : 1.0%
n_episode :7000, score : 124.0, n_buffer : 50000, eps : 1.0%
n_episode :7020, score : 127.9, n_buffer : 50000, eps : 1.0%
n_episode :7040, score : 128.3, n_buffer : 50000, eps : 1.0%
n_episode :7060, score : 149.6, n_buffer : 50000, eps : 1.0%
n_episode :7080, score : 131.8, n_buffer : 50000, eps : 1.0%
n_episode :7100, score : 126.0, n_buffer : 50000, eps : 1.0%
n_episode :7120, score : 148.3, n_buffer : 50000, eps : 1.0%
n_episode :7140, score : 155.2, n_buffer : 50000, eps : 1.0%
n_episode :7160, score : 153.3, n_buffer : 50000, eps : 1.0%
n_episode :7180, score : 168.1, n_buffer : 50000, eps : 1.0%
n_episode :7200, score : 150.8, n_buffer : 50000, eps : 1.0%
n_episode :7220, score : 148.9, n_buffer : 50000, eps : 1.0%
n_episode :7240, score : 163.8, n_buffer : 50000, eps : 1.0%
n_episode :7260, score : 149.8, n_buffer : 50000, eps : 1.0%
n_episode :7280, score : 180.5, n_buffer : 50000, eps : 1.0%
n_episode :7300, score : 157.3, n_buffer : 50000, eps : 1.0%
n_episode :7320, score : 147.9, n_buffer : 50000, eps : 1.0%
n_episode :7340, score : 145.8, n_buffer : 50000, eps : 1.0%
n_episode :7360, score : 148.9, n_buffer : 50000, eps : 1.0%
n_episode :7380, score : 147.8, n_buffer : 50000, eps : 1.0%
n_episode :7400, score : 166.9, n_buffer : 50000, eps : 1.0%
n_episode :7420, score : 180.7, n_buffer : 50000, eps : 1.0%
n_episode :7440, score : 181.1, n_buffer : 50000, eps : 1.0%
n_episode :7460, score : 206.9, n_buffer : 50000, eps : 1.0%
n_episode :7480, score : 186.3, n_buffer : 50000, eps : 1.0%
n_episode :7500, score : 168.9, n_buffer : 50000, eps : 1.0%
n_episode :7520, score : 168.9, n_buffer : 50000, eps : 1.0%
n_episode :7540, score : 147.3, n_buffer : 50000, eps : 1.0%
n_episode :7560, score : 134.7, n_buffer : 50000, eps : 1.0%
n_episode :7580, score : 165.4, n_buffer : 50000, eps : 1.0%
```

```
n_episode :7600, score : 123.2, n_buffer : 50000, eps : 1.0%
n_episode :7620, score : 146.1, n_buffer : 50000, eps : 1.0%
n_episode :7640, score : 117.4, n_buffer : 50000, eps : 1.0%
n_episode :7660, score : 168.7, n_buffer : 50000, eps : 1.0%
n_episode :7680, score : 125.5, n_buffer : 50000, eps : 1.0%
n_episode :7700, score : 121.6, n_buffer : 50000, eps : 1.0%
n_episode :7720, score : 129.2, n_buffer : 50000, eps : 1.0%
n_episode :7740, score : 130.9, n_buffer : 50000, eps : 1.0%
n_episode :7760, score : 132.2, n_buffer : 50000, eps : 1.0%
n_episode :7780, score : 116.5, n_buffer : 50000, eps : 1.0%
n_episode :7800, score : 123.2, n_buffer : 50000, eps : 1.0%
n_episode :7820, score : 126.8, n_buffer : 50000, eps : 1.0%
n_episode :7840, score : 134.8, n_buffer : 50000, eps : 1.0%
n_episode :7860, score : 121.9, n_buffer : 50000, eps : 1.0%
n_episode :7880, score : 123.8, n_buffer : 50000, eps : 1.0%
n_episode :7900, score : 110.5, n_buffer : 50000, eps : 1.0%
n_episode :7920, score : 109.2, n_buffer : 50000, eps : 1.0%
n_episode :7940, score : 108.7, n_buffer : 50000, eps : 1.0%
n_episode :7960, score : 123.2, n_buffer : 50000, eps : 1.0%
n_episode :7980, score : 133.8, n_buffer : 50000, eps : 1.0%
n_episode :8000, score : 138.6, n_buffer : 50000, eps : 1.0%
n_episode :8020, score : 129.0, n_buffer : 50000, eps : 1.0%
n_episode :8040, score : 209.0, n_buffer : 50000, eps : 1.0%
n_episode :8060, score : 168.2, n_buffer : 50000, eps : 1.0%
n_episode :8080, score : 157.8, n_buffer : 50000, eps : 1.0%
n_episode :8100, score : 146.9, n_buffer : 50000, eps : 1.0%
n_episode :8120, score : 159.7, n_buffer : 50000, eps : 1.0%
n_episode :8140, score : 152.3, n_buffer : 50000, eps : 1.0%
n_episode :8160, score : 111.0, n_buffer : 50000, eps : 1.0%
n_episode :8180, score : 132.2, n_buffer : 50000, eps : 1.0%
n_episode :8200, score : 166.3, n_buffer : 50000, eps : 1.0%
n_episode :8220, score : 164.9, n_buffer : 50000, eps : 1.0%
n_episode :8240, score : 236.2, n_buffer : 50000, eps : 1.0%
n_episode :8260, score : 131.2, n_buffer : 50000, eps : 1.0%
n_episode :8280, score : 154.7, n_buffer : 50000, eps : 1.0%
n_episode :8300, score : 151.8, n_buffer : 50000, eps : 1.0%
n_episode :8320, score : 175.2, n_buffer : 50000, eps : 1.0%
n_episode :8340, score : 177.9, n_buffer : 50000, eps : 1.0%
n_episode :8360, score : 182.6, n_buffer : 50000, eps : 1.0%
n_episode :8380, score : 135.7, n_buffer : 50000, eps : 1.0%
n_episode :8400, score : 161.3, n_buffer : 50000, eps : 1.0%
n_episode :8420, score : 124.9, n_buffer : 50000, eps : 1.0%
n_episode :8440, score : 100.6, n_buffer : 50000, eps : 1.0%
n_episode :8460, score : 140.8, n_buffer : 50000, eps : 1.0%
n_episode :8480, score : 144.8, n_buffer : 50000, eps : 1.0%
n_episode :8500, score : 212.1, n_buffer : 50000, eps : 1.0%
n_episode :8520, score : 238.8, n_buffer : 50000, eps : 1.0%
n_episode :8540, score : 117.2, n_buffer : 50000, eps : 1.0%
```

```
n_episode :8560, score : 105.8, n_buffer : 50000, eps : 1.0%
n_episode :8580, score : 108.2, n_buffer : 50000, eps : 1.0%
n_episode :8600, score : 144.7, n_buffer : 50000, eps : 1.0%
n_episode :8620, score : 140.3, n_buffer : 50000, eps : 1.0%
n_episode :8640, score : 179.1, n_buffer : 50000, eps : 1.0%
n_episode :8660, score : 125.1, n_buffer : 50000, eps : 1.0%
n_episode :8680, score : 119.8, n_buffer : 50000, eps : 1.0%
n_episode :8700, score : 119.8, n_buffer : 50000, eps : 1.0%
n_episode :8720, score : 127.5, n_buffer : 50000, eps : 1.0%
n_episode :8740, score : 123.0, n_buffer : 50000, eps : 1.0%
n_episode :8760, score : 150.1, n_buffer : 50000, eps : 1.0%
n_episode :8780, score : 156.9, n_buffer : 50000, eps : 1.0%
n_episode :8800, score : 113.0, n_buffer : 50000, eps : 1.0%
n_episode :8820, score : 129.4, n_buffer : 50000, eps : 1.0%
n_episode :8840, score : 124.2, n_buffer : 50000, eps : 1.0%
n_episode :8860, score : 159.6, n_buffer : 50000, eps : 1.0%
n_episode :8880, score : 127.8, n_buffer : 50000, eps : 1.0%
n_episode :8900, score : 142.9, n_buffer : 50000, eps : 1.0%
n_episode :8920, score : 113.9, n_buffer : 50000, eps : 1.0%
n_episode :8940, score : 155.6, n_buffer : 50000, eps : 1.0%
n_episode :8960, score : 154.3, n_buffer : 50000, eps : 1.0%
n_episode :8980, score : 153.5, n_buffer : 50000, eps : 1.0%
n_episode :9000, score : 128.1, n_buffer : 50000, eps : 1.0%
n_episode :9020, score : 124.2, n_buffer : 50000, eps : 1.0%
n_episode :9040, score : 115.5, n_buffer : 50000, eps : 1.0%
n_episode :9060, score : 119.9, n_buffer : 50000, eps : 1.0%
n_episode :9080, score : 100.0, n_buffer : 50000, eps : 1.0%
n_episode :9100, score : 118.6, n_buffer : 50000, eps : 1.0%
n_episode :9120, score : 123.1, n_buffer : 50000, eps : 1.0%
n_episode :9140, score : 137.3, n_buffer : 50000, eps : 1.0%
n_episode :9160, score : 116.8, n_buffer : 50000, eps : 1.0%
n_episode :9180, score : 162.7, n_buffer : 50000, eps : 1.0%
n_episode :9200, score : 96.2, n_buffer : 50000, eps : 1.0%
n_episode :9220, score : 144.8, n_buffer : 50000, eps : 1.0%
n_episode :9240, score : 171.8, n_buffer : 50000, eps : 1.0%
n_episode :9260, score : 182.7, n_buffer : 50000, eps : 1.0%
n_episode :9280, score : 188.8, n_buffer : 50000, eps : 1.0%
n_episode :9300, score : 249.4, n_buffer : 50000, eps : 1.0%
n_episode :9320, score : 182.7, n_buffer : 50000, eps : 1.0%
n_episode :9340, score : 124.3, n_buffer : 50000, eps : 1.0%
n_episode :9360, score : 167.9, n_buffer : 50000, eps : 1.0%
n_episode :9380, score : 189.5, n_buffer : 50000, eps : 1.0%
n_episode :9400, score : 156.9, n_buffer : 50000, eps : 1.0%
n_episode :9420, score : 134.1, n_buffer : 50000, eps : 1.0%
n_episode :9440, score : 152.1, n_buffer : 50000, eps : 1.0%
n_episode :9460, score : 209.9, n_buffer : 50000, eps : 1.0%
n_episode :9480, score : 158.2, n_buffer : 50000, eps : 1.0%
n_episode :9500, score : 219.2, n_buffer : 50000, eps : 1.0%
```

```
n_episode :9520, score : 165.7, n_buffer : 50000, eps : 1.0%
n_episode :9540, score : 189.4, n_buffer : 50000, eps : 1.0%
n_episode :9560, score : 221.3, n_buffer : 50000, eps : 1.0%
n_episode :9580, score : 239.9, n_buffer : 50000, eps : 1.0%
n_episode :9600, score : 216.3, n_buffer : 50000, eps : 1.0%
n_episode :9620, score : 215.3, n_buffer : 50000, eps : 1.0%
n_episode :9640, score : 163.2, n_buffer : 50000, eps : 1.0%
n_episode :9660, score : 187.2, n_buffer : 50000, eps : 1.0%
n_episode :9680, score : 123.2, n_buffer : 50000, eps : 1.0%
n_episode :9700, score : 157.2, n_buffer : 50000, eps : 1.0%
n_episode :9720, score : 217.2, n_buffer : 50000, eps : 1.0%
n_episode :9740, score : 192.8, n_buffer : 50000, eps : 1.0%
n_episode :9760, score : 156.0, n_buffer : 50000, eps : 1.0%
n_episode :9780, score : 132.5, n_buffer : 50000, eps : 1.0%
n_episode :9800, score : 148.5, n_buffer : 50000, eps : 1.0%
n_episode :9820, score : 118.3, n_buffer : 50000, eps : 1.0%
n_episode :9840, score : 141.0, n_buffer : 50000, eps : 1.0%
n_episode :9860, score : 146.2, n_buffer : 50000, eps : 1.0%
n_episode :9880, score : 154.7, n_buffer : 50000, eps : 1.0%
n_episode :9900, score : 118.5, n_buffer : 50000, eps : 1.0%
n_episode :9920, score : 112.5, n_buffer : 50000, eps : 1.0%
n_episode :9940, score : 150.2, n_buffer : 50000, eps : 1.0%
n_episode :9960, score : 154.9, n_buffer : 50000, eps : 1.0%
n_episode :9980, score : 121.9, n_buffer : 50000, eps : 1.0%
```



When we change the gamma value from 0.98 to 0.75, we observe the scores increase greatly compared

to when the gamma was 0.75. Still the gamma that performs the best is the 0.98