REPORT Reinforcement Learning

TD 1 - MDP

EXERCICE 1

Q2- Describe the MDP associated to this environment and formalize mathematically the goal of an agent.

The environment has 16 potential states and 4 actions. The states are composed of : starting cell S, frozen cells (F) for safe states, a hole (H) that should be avoided, and the goal cell G that should be reached. The agent must learn how to reach G from S while avoiding H. For a given action for a given state the agent has a probability of 1/3 to access the desired state.

Q5- Compare the result of this question with the Monte-Carlo estimation of the previous question and check for consistency.

There is a global consistency between both methods. However, the linear system method is more efficient, 86 000 times faster ! Indeed on my computer the results from both methods are the following :

- Monte Carlo method Running time: 60.1899 sec

Value estimate of the starting point: 0.013
Value function of the always RIGHT policy:

0.0128 0.0117 0.0278 0.0
0.0189 0.0 0.0646 0.0
0.0492 0.147 0.186 0.0
0.0 0.301 0.557 0.0

- Linear System method Running time: 0.0007 sec

Value estimate of the starting point: 0.013
Value function of the always RIGHT policy:

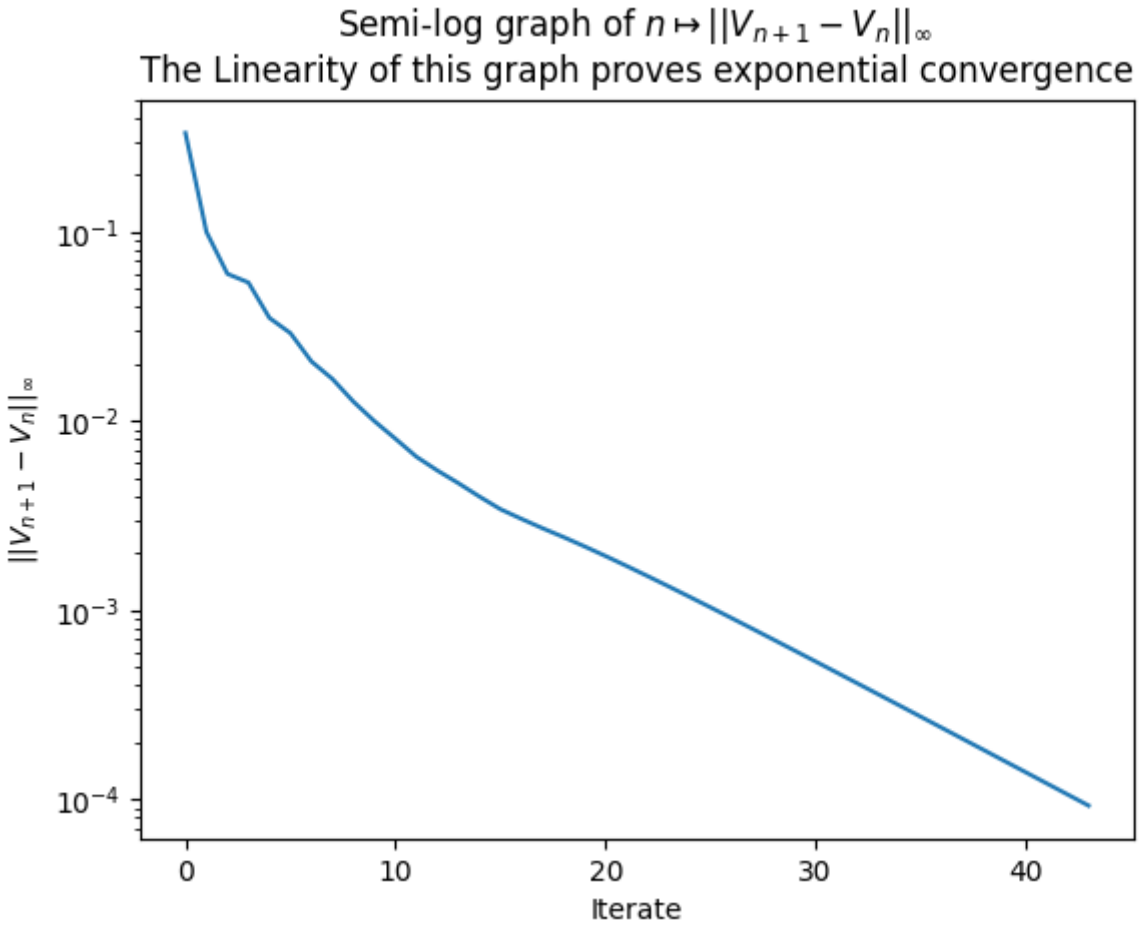
0.0131 0.0118 0.0274 1.15e-16 0.0188 1.1e-16 0.064 1.54e-16 0.0494 0.146 0.186 0.0 0.0 0.301 0.556 0.0

Q6- What could be a good stopping criterion for your algorithm?

The algorithm must stop when there is no more improvement. A good stopping criterion is therefore a very smaller number (which is compared to the difference of the absolute difference between the two value-functions from the 2 last iterations).

Q7 -

In the previous question we filled the Pi-function according to the pi policy and then we updated the value function. Now to get the optimal function without following a particular policy : at each state each action must be considered. I created a find_best_action function to get at a given state the best action to consider.



Q8-

Q9- Compare the two methods

The value iteration and policy iteration methods give the same policy functions. The difference is in the running time : the policy iteration method is more efficient.

- Value iteration algorithm
  Running time: 0.0164 sec

An optimal policy is:

←↑←↑
←←←←
↑↓←←
←→↓←

- Policy iteration algorithm
  Running time: 0.0050 sec

An optimal policy is:

←↑←↑
←←←←
↑↓←←
←→↓←

Q-10 : 13

refer to the .py