Foundations of Agents: Practical Assignment 1

Kevin Trebing (i6192338)

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1 Tower of Hanoi problem

In a Tower of Hanoi problem the agent needs to move disks of different sizes from one pin to another pin. Furthermore, the disks need to be in the order that a smaller disk needs to be on top of a bigger one. Only one disk can be moved at a time and only the topmost disk can be moved. In our problem we have 3 pins and two disks. The starting position is pin 1 and the smaller disk is on the bigger disk. The goal is to move the disks to pin 3.

1.1 Description of States

Notation:

- a = small disk,
- b = big disk,
- 1 = pin1,

- 2 = pin2,
- 3 = pin3,
- ab = a is on b

We have 12 different possible states:

State	Pin		
s_0	ab1	2	3
s_1	1	ab2	3
s_2	1	2	ab3
s_3	ba1	2	3
s_4	1	ba2	3
s_5	1	2	ba3
s_6	b1	a2	3
s_7	a1	b2	3
s_8	b1	2	a3
s_9	a1	2	b3
s_{10}	1	a2	b3
s_{11}	1	b2	a3

1.2 Description of Actions

We have 6 different actions that the agent can take.

Action	effect
a_1	move a to pin1
a_2	move a to pin2
a_3	move a to pin3
b_1	move b to pin1
b_2	move b to pin2
b_3	move b to pin3

2 Optimal policy

The optimal policy describes for every state the best action the agent should take.

- $\pi(s_0) = a_2$
- $\pi(s_1) = a_1$
- $\pi(s_2) = a_1$
- $\pi(s_3) = b_3$
- $\pi(s_4) = b_3$
- $\pi(s_5) = b_2$

- $\pi(s_6) = b_3$
- $\pi(s_7) = b_3$
- $\pi(s_8) = a_2$
- $\pi(s_9) = a_3$
- $\pi(s_{10}) = a_3$
- $\pi(s_{11}) = a_1$

3 Q-values

The q-values of of the states given the optimal policy:

- $u(s_0) = 75.55$
- $u(s_1) = 75.30$
- $u(s_2) = 0.00$
- $u(s_3) = 86.82$
- $u(s_4) = 86.92$
- $u(s_5) = 65.73$

- $u(s_6) = 85.95$
- $u(s_7) = 86.03$
- $u(s_8) = 74.16$
- $u(s_9) = 98.82$
- $u(s_{10}) = 98.82$
- $u(s_{11}) = 75.29$

4 Difference to value and policy iteration

The major difference is that the results could differ a lot due to randomness. The q-values sometimes are very similar to the utility values calculated from the previous assignment.

5 Convergence speed

TODO

6 Note

The Hanoi.py file requires Python 3.6.