
Homework 4

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1. Shortest path in a Graph as an MDP

Design idea. In order to model the shortest path problem, the designed MDP need to ensure that for every states, the ones with closer distance to the goal state must have higher utility value.

MDP formulation.

Given the input of the problem (V, E, v_g) , we encode it to a MDP formulation as $\{S, A, T, \gamma, R\}$.

$$\left\{ \begin{array}{l} S = V \\ A_{(s)} = \{s \Rightarrow s' \mid \text{there's a directed edge from } s \text{ to } s' \text{ in } E\} \\ P(s'|s, a) = 1, \text{ if } a = (s \Rightarrow s') \in A_{(s)} \\ \gamma = 0.9 \\ R_{(s)} = \begin{cases} 10, & \text{if } s \text{ is } v_g \\ 0, & \text{otherwise} \end{cases} \end{array} \right. \quad (1)$$

2. (b) Results

state	Value	Policy
$(0, 0, 0, a)$	0.0667	a
$(2, 0, 4, b)$	0.3887	c
$(5, 2, 1, c)$	0.2724	a