

Foundations of Artificial Intelligence

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Exercise Sheet 9

Due: Friday, July 2, 2021

Exercise 9.1 (Markov Decision Processes)

Consider the Markov decision process underlying the sequence decision problem for the grid world in exercise 8.2.

- (a) Perform a policy-improvement step for the initial state **S** and the (non-optimal) policy **E**. Which is the optimal action in this state? The utility of all non-terminal states is assumed to be zero and rewards are assumed to be additive (i.e. not discounted).
- (b) Perform a first step of the value iteration algorithm for state (4,3) for the slightly **modified grid world** below. The immediate reward of this state is $R = -1$. Assume discounted rewards and a discount factor of $\gamma = 0.5$. Initially, all non-terminal states have a utility of zero.

4					
3					$R = -1$
2			1		10
1					
0	-10	-10	-10	-10	-10
	0	1	2	3	4

Exercise 9.2 (Decision Trees)

Specify decision trees representing the following boolean functions:

- (a) $A \text{ XOR } B$
- (b) $(A \wedge B) \vee (C \wedge D)$

Note: The exercise sheets may be worked on in groups of up to three students.