

Foundations of Artificial Intelligence

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Exercise Sheet 11

Due: Friday, July 13, 2007

Exercise 11.1 (Acting under uncertainty)

Consider the following part of an $n \times m$ world. The actions of the agent can be N (go north), E (go east), S (go south), and W (go west). Each action achieves its intended effect with probability 0.4, but the rest of the time, the agent moves at right angles to the intended direction (same probability for left and right). The numbers in the squares specify the utilities.

- (a) Calculate the utility of the square (2,2), given it has a reward of 0.3 and the best action is E. Assume a discount factor $\gamma = 0.5$.

	1	2	3
3		u=0.6	
2		→	u=0.5
1		u=0.4	

- (b) What is the best action for the agent in the figure below assuming it is in the cell marked *A*? Explain your answer.

	1	2	3
3	u=0.7	u=0.6	u=0.1
2	u=0.8	A	u=0.7
1	u=0.9	u=0.1	u=0.9

Exercise 11.2 (Independencies in Bayesian networks)

Consider that a random variable is independent from all the others in the Bayesian network, given the Markov blanket. Derive the following formula:

$$P(X = x | mb(X)) = \alpha P(X = x | parents(X)) \prod_{Y_j \in children(X)} P(Y_j = y_j | parents(Y_j)),$$

where mb is the Markov blanket.

The exercise sheets may and should be worked on in groups of three (3) students. Please write all your names and the number of your exercise group on your solution.