Assignment 2 (*10 points*)

Markov Decision Process (MDP) and Value-iteration

Consider a 4x4 grid-world. Here, the agent starts in state s1,1 and must reach the goal in state s4,4. There are two danger-states in s3,2 and s3,4. The reward for the transition into danger-states is -1 and the reward for transitioning into goal-state is +10 and let the living reward be -0.1 for every other state. Consider possible actions as . Define as 0 for all non-terminal states and +10 for the goal state and -1 for the two danger-states. Let the discount factor be . Consider the probability of transitioning to the intended state as 70% and every other state as 10%.

**NOTE**: Please use “Equation” in Word for math notations

Table 1: Given 4x4 grid world

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**Tasks**:

1. Write down the equation for value-iteration. Define each term and explain in your own words what each term is (*1 point*)

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| = The value of state at iteration  = All possible actions  = The probability of transitioning to state from state given action .  = This represents the Markov Decision Process, the uncertainty in the environment.  = The reward received after transitioning from state 𝑠 to state given action .  = The discount factor which reflects the importance of future rewards.  = The next state. |

1. Convert the given problem statement into math notations and define States, Actions, Reward Function and Transition Function (*1 point*)

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1. Perform value-iteration for 5 iterations and calculate and for all 16 states (*8 points*)
2. Please enter values for (*2 points*)

|  |  |  |  |
| --- | --- | --- | --- |
| -0.10 | -0.10 | -0.10 | -0.10 |
| -0.10 | -0.28 | -0.10 | -0.28 |
| -0.28 | -0.10 | -0.46 | 13.09 |
| -0.10 | -0.28 | 13.27 | 15.00 |

1. Please enter values for (*2 points*)

|  |  |  |  |
| --- | --- | --- | --- |
| -0.28 | -0.28 | -0.28 | 4.55 |
| -0.29 | -0.40 | 6.35 | 10.89 |
| -0.41 | 6.40 | 12.29 | 23.22 |
| 4.95 | 11.54 | 23.38 | 26.20 |

1. Please enter values for (*2 points*)

|  |  |  |  |
| --- | --- | --- | --- |
| -0.42 | 2.95 | 6.32 | 11.64 |
| 2.90 | 5.91 | 13.24 | 19.51 |
| 5.94 | 13.26 | 21.21 | 31.88 |
| 12.14 | 20.27 | 32.05 | 35.15 |

1. Please enter values for (*2 points*)

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