MDPs

TOTAL POINTS 16

1. The learner and decision maker is the _______.

1 point

- Reward
- State
- Environment
- Agent

2. At each time step the agent takes an _______.

1 point

- Environment
- Action
- State
- Reward

3. What equation(s) define $q_\pi(S_t, A_t)$ in terms of subsequent rewards?

1 point

- $q_\pi(s,a) = \mathbb{E}_\pi[R_{t+1} | S_t = s, A_t = a]$
- $q_\pi(s,a) = [G_t | S_t = s, A_t = a]$

  where: $G_t = R_{t+1} + \gamma R_{t+2} + \gamma^2 R_{t+3} + \gamma^3 R_{t+4} \ldots$
- $q_\pi(s,a) = \mathbb{E}_\pi[G_t | S_t = s, A_t = a]$

  where: $G_t = R_{t+1} + \gamma R_{t+2} + \gamma^2 R_{t+3} + \gamma^3 R_{t+4} \ldots$
- $q_\pi(s,a) = \mathbb{E}_\pi[G_t]$

  where: $G_t = R_{t+1} + \gamma R_{t+2} + \gamma^2 R_{t+3} + \gamma^3 R_{t+4} \ldots$
- $q_\pi(s,a) = \mathbb{E}_\pi[R_{t+1} + \gamma R_{t+2} + \gamma^2 R_{t+3} + \gamma^3 R_{t+4} \ldots | S_t = s, A_t = a]$

4. Imagine the agent is learning in an episodic problem. Which of the following is true?

1 point

- The number of steps in an episode is always the same.
- The number of steps in an episode is stochastic: each episode can have a different number of steps.
- The agent takes the same action at each step during an episode.

5. If the reward is always +1 what is the sum of the discounted infinite return when $\gamma < 1$

1 point

$G_t = \sum_{k=0}^{\infty} \gamma^k R_{t+k+1}$

- Infinity.
- $G_t = \frac{1}{1-\gamma}$
- $G_t = \frac{\gamma}{1-\gamma}$
- $G_t = 1 * \gamma^k$

6. What is the difference between a small gamma (discount factor) and a large gamma?

1 point

- The size of the discount factor has no effect on the agent.
- With a larger discount factor the agent is more far-sighted and considers rewards farther into the future.
- With a smaller discount factor the agent is more far-sighted and considers rewards farther into the future.

7. Suppose $\gamma = 0.8$ and we observe the following sequence of rewards: $R_1 = -3$, $R_2 = 5$, $R_3 = 2$, $R_4 = 7$, and $R_5 = 1$, with $T = 5$. What is G_0? Hint: Work Backwards and recall that $G_t = R_{t+1} + \gamma G_{t+1}$.

1 point

- 6.2736
- 11.592
- 12
- -3
- 8.24

8. Suppose $\gamma = 0.8$ and the reward sequence is $R_1 = 5$ followed by an infinite sequence of 10s. What is G_0?

1 point

- 55
- 15
- 45

9. Suppose reinforcement learning is being applied to determine moment-by-moment temperatures and stirring rates for a bioreactor (a large vat of nutrients and bacteria used to produce useful chemicals). The actions in such an application might be target temperatures and target stirring rates that are passed to lower-level control systems that, in turn, directly activate heating elements and motors to attain the targets. The states are likely to be thermocouple and other sensory readings, perhaps filtered and delayed, plus symbolic inputs representing the ingredients in the vat and the target chemical. The rewards might be moment-by-moment measures of the rate at which the useful chemical is produced by the bioreactor. Notice that here each state is a list, or vector, of sensor readings and symbolic inputs, and each action is a vector consisting of a target temperature and a stirring rate. Is this a valid MDP?

1 point

- Yes
- No

10. Consider using reinforcement learning to control the motion of a robot arm in a repetitive pick-and-place task. If we want to learn movements that are fast and smooth, the learning agent will have to control the motors directly and have low-latency information about the current positions and velocities of the mechanical linkages. The actions in this case might be the voltages applied to each motor at each joint, and the states might be the latest readings of joint angles and velocities. The reward might be +1 for each object successfully picked up and placed. To encourage smooth movements, on each time step a small, negative reward can be given as a function of the moment-to-moment "jerkiness" of the motion. Is this a valid MDP?

1 point

- ○ Yes
- ○ No

11. Imagine that you are a vision system. When you are first turned on for the day, an image floods into your camera. You can see lots of things, but not all things. You can't see objects that are occluded, and of course you can't see objects that are behind you. After seeing that first scene, do you have access to the Markov state of the environment? Suppose your camera was broken that day and you received no images at all, all day. Would you have access to the Markov state then? 1 point

- ○ You have access to the Markov state before and after damage.
- ○ You have access to the Markov state before damage, but you don't have access to the Markov state after damage.
- ○ You don't have access to the Markov state before damage, but you do have access to the Markov state after damage.
- ○ You don't have access to the Markov state before or after damage.

12. What does MDP stand for? 1 point

- ○ Markov Deterministic Policy
- ○ Markov Decision Protocol
- ○ Markov Decision Process
- ○ Meaningful Decision Process

13. What is the reward hypothesis? 1 point

- ○ Goals and purposes can be thought of as the minimization of the expected value of the cumulative sum of rewards received.
- ○ Always take the action that gives you the best reward at that point.
- ○ Ignore rewards and find other signals.
- ○ Goals and purposes can be thought of as the maximization of the expected value of the cumulative sum of rewards received.

14. Imagine, an agent is in a maze-like gridworld. You would like the agent to find the goal, as quickly as possible. You give the agent a reward of +1 when it reaches the goal and the discount rate is 1.0, because this is an episodic task. When you run the agent its finds the goal, but does not seem to care how long it takes to complete each episode. How could you fix this? (Select all that apply) 1 point

- ☐ Give the agent a reward of +1 at every time step.
- ☐ Give the agent -1 at each time step.
- ☐ Set a discount rate less than 1 and greater than 0, like 0.9.
- ☐ Give the agent a reward of 0 at every time step so it wants to leave.

15. When may you want to formulate a problem as episodic? 1 point

- ○ When the agent-environment interaction naturally breaks into sequences. Each sequence begins independently of how the episode ended.

- When the agent-environment interaction does not naturally break into sequences. Each new episode begins independently of how the previous episode ended.

16. When may you want to formulate a problem as continuing?

1 point

- When the agent-environment interaction naturally breaks into sequences and each sequence begins independently of how the previous sequence ended.
- When the agent-environment interaction does not naturally break into sequences. Each new episode begins independently of how the previous episode ended.

I, **Dhawal Gupta**, understand that submitting work that isn't my own may result in permanent failure of this course or deactivation of my Coursera account.

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