6. Bellman Equations
Bellman Equations

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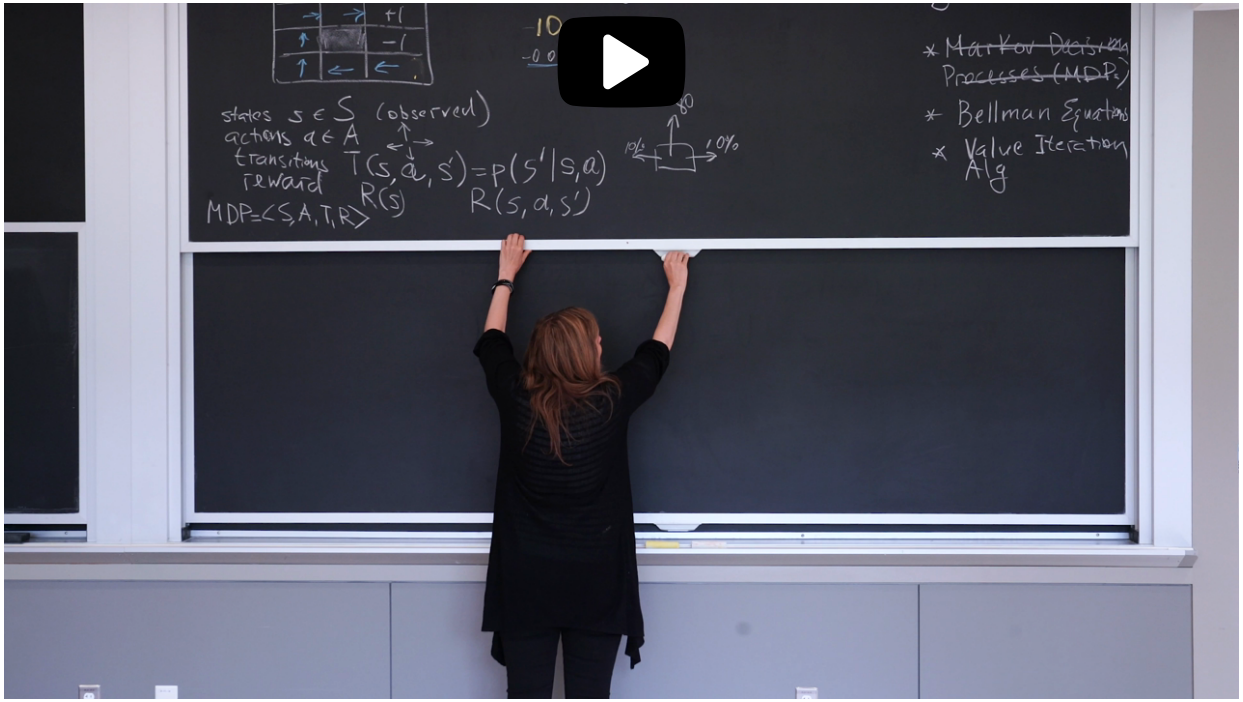
So now we will start introducing a tiny bit more notation.



Just three.

I promise to discuss Bellman equations.

So the first annotation that I will introduce,

as I already alluded, is called V. V star.

This is the value of state.

What does it mean?

It tells you the value of the expected reward

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In this problem, we work through a numerical example to understand the Bellman equations:

Let there be 4 possible actions, a_1, a_2, a_3, a_4 from a given state s and assume while answering the following problems that the Q^* values are given as below:

$$Q^*(s, a_1) = 10 Q^*(s, a_2) = -1 Q^*(s, a_3) = 0 Q^*(s, a_4) = 11$$

Recall from the lecture that,

$$V^*(s) = \max_a Q^*(s, a)$$

$$Q^*(s, a) = \sum_{s'} T(s, a, s') \left(R(s, a, s') + \gamma V^*(s') \right)$$

Value function in terms of Q function

1/1 point (graded)
Enter the value of $V^*(s)$ below:

11 ✔ **Answer:** 11

Solution:

Note that $V^*(s)$ is given by:

$$V^*(s) = \max_a Q^*(s,a)$$

$$V^*(s) = \max(10, -1, 0, 11) = 11$$

Submit You have used 1 of 2 attempts

Answers are displayed within the problem

Bellman Equation for Q function

1/1 point (graded)

Let s' be a state that can be reached from s by taking the action a_1. Also assume that

$$T(s, a_1, s') = 1 R(s, a_1, s') = 5\gamma = 0.5$$

Enter the value of $V^*(s')$ below:

10 ✔ **Answer:** 10

Solution:

Note that since T denotes probabilities, the following must be true:

$$\sum_{s'} T(s, a, s') = 1$$

. Also,

$$Q^*(s, a) = \sum_{s'} T(s, a, s') \left(R(s, a, s') + \gamma V^*(s')\right)$$

Since, $T(s, a_1, s') = 1$ and $\sum_{s'} T(s, a, s') = 1$, we would have $T(s, a_1, s\ ") = 0 \quad \forall s\ " \neq s'$.
The above equation would then reduce as follows

$$Q^*(s, a_1) = T(s, a_1, s') \left(R(s, a_1, s') + \gamma V^*(s')\right)$$

$$10 = 1 * (5 + 0.5 * V^*(s'))$$

$$V^*(s') = 5/0.5 = 10$$

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Answers are displayed within the problem

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? The values are missing spacing and are hard to read 1