Practice: Value Functions and Bellman Equations

TOTAL POINTS 10

1. A policy is a function which maps ____ to ____. — 1 point

- Actions to probability distributions over values.
- States to actions.
- Actions to probabilities.
- States to values.
- States to probability distributions over actions.

2. The term "backup" most closely resembles the term ___ in meaning. — 1 point

- Value
- Update
- Diagram

3. At least one deterministic optimal policy exists in every Markov decision process. — 1 point

- True
- False

4. The optimal state-value function: — 1 point

- Is not guaranteed to be unique, even in finite Markov decision processes.
- Is unique in every finite Markov decision process.

5. Does adding a constant to all rewards change the set of optimal policies in episodic tasks? — 1 point

- Yes, adding a constant to all rewards changes the set of optimal policies.
- No, as long as the relative differences between rewards remain the same, the set of optimal policies is the same.

6. Does adding a constant to all rewards change the set of optimal policies in continuing tasks? — 1 point

- No, as long as the relative differences between rewards remain the same, the set of optimal policies is the same.
- Yes, adding a constant to all rewards changes the set of optimal policies.

7. Select the equation that correctly relates v_* to q_*. Assume π is the uniform random policy. — 1 point

- $v_*(s) = \sum_{a,r,s'} \pi(a|s)p(s', r|s, a)q_*(s')$
- $v_*(s) = \sum_{a,r,s'} \pi(a|s)p(s', r|s, a)[r + \gamma q_*(s')]$
- $v_*(s) = \sum_{a,r,s'} \pi(a|s)p(s', r|s, a)[r + q_*(s')]$
- $v_*(s) = max_a q_*(s, a)$

8. Select the equation that correctly relates q_* to v_* using four-argument function p. 1 point

- $q_*(s, a) = \sum_{s',r} p(s', r|a, s)[r + v_*(s')]$
- $q_*(s, a) = \sum_{s',r} p(s', r|a, s)\gamma[r + v_*(s')]$
- $q_*(s, a) = \sum_{s',r} p(s', r|a, s)[r + \gamma v_*(s')]$

9. Write a policy π_* in terms of q_*. 1 point

- $\pi_*(a|s) = q_*(s, a)$
- $\pi_*(a|s) = \max_{a'} q_*(s, a')$
- $\pi_*(a|s) = 1 \text{ if } a = \text{argmax}_{a'} q_*(s, a'), \text{ else } 0$

10. Give an equation for some π_* in terms of v_* and the four-argument p. 1 point

- $\pi_*(a|s) = 1 \text{ if } v_*(s) = \sum_{s',r} p(s', r|s, a)[r + \gamma v_*(s')], \text{ else } 0$
- $\pi_*(a|s) = \max_{a'} \sum_{s',r} p(s', r|s, a')[r + \gamma v_*(s')]$
- $\pi_*(a|s) = 1 \text{ if } v_*(s) = \max_{a'} \sum_{s',r} p(s', r|s, a')[r + \gamma v_*(s')], \text{ else } 0$
- $\pi_*(a|s) = \sum_{s',r} p(s', r|s, a)[r + \gamma v_*(s')]$
