Henzi Kou

CIS 471: Introduction to Artificial Intelligence

Prof. Thanh H. Nguyen

13 November 2019

<center>Homework 3</center>

1. **Value Iteration**

    i. $V_0(d) = 0$

        $V_1(d) = 0$

        $V_2(d) = 1$

        $V_3(d) = 1$

        $V_4(d) = 10$

        $V_5(d) = 10$

    ii. $V^*(a) = 10$

        $V^*(b) = 0.2 \cdot max(a, c) = 0.2 \cdot max(10, 0) = 2$

        $V^*(c) = 0.2 \cdot max(b, d) = 0.2 \cdot max(2, 0) = 0.4$

        $V^*(d) = 0.2 \cdot max(c, e) = 0.2 \cdot max(0.4, 1) = 0.2$

        $V^*(e) = 1$

2. **Policy Iteration: Cycle**

    i. $V_{k+1}^{\pi}(A) = -0.92$

    ii. $Q_{\infty}^{\pi}(A, clockwise) = -0.1722$

        $Q_{\infty}^{\pi}(A, counterclockwise) = -0.2026$

        The updated action for A is *clockwise*.

3. **Temporal Difference Learning**

    i. $V^{\pi}(A) = 1$

        $V^{\pi}(B) = 4$

        $V^{\pi}(C) = 8$

        $V^{\pi}(D) = 10$

        $V^{\pi}(E) = 10$

4. **Model-Free Reinforcement Learning: Cycle**

    i. $Q(A, clockwise) = 1.501$

        $Q(A, counterclockwise) = 6.259$

$$Q(B, clockwise) = -0.451$$

$$Q(B, counterclockwise) = -6.005$$

$$Q(C, clockwise) = 2.73$$

$$Q(C, counterclockwise) = 2.63125$$

5. **Feature-Based Representation**

    i. $Q(s, west) = 9$

        $Q(s, south) = 8$

        Action chosen is *west*.

    ii.