Intro to AI Homework 2

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March 1, 2024

1 Problem 1

1.1

$Q^1(A,1) = 0(0 + 1 \text{ x } 0) + 1\ (0 + 1 \text{ x } 0) = 0$
$Q^1(A,2) = 1(2 + 1 \text{ x } 0) + 0(0 + 1 \text{ x } 0) = 2$
$Q^1(A,3) = 0.5(0 + 1 \text{ x } 0) + .5(0 + 1 \text{ x } 0) = 0$
$Q^1(B,1) = .5(12 + 1 \text{ x } 0) + .5(0 + 1 \text{ x } 0) = 6$
$Q^1(B,2) = 1(0 + 1 \text{ x } 0) + 0(0 + 1 \text{ x } 0) = 0$
$Q^1(B,3) = .5(2 + (1*0)) + .5\ (4 + (1*0)) = 3$
$Q^2(A,1) = 0(...)\ + 1(\ 0 + 1 \text{ x } 6) = 6$
$Q^2(A,2) = 1(2+1\text{x}2) + 0(...) = 4$
$Q^2(A,3) = .5(0+1\text{x}2) + .5(0+1\text{x}6) = 4$
$Q^2(B,1) = .5\ (12 + 1 \text{ x } 2) + .5(0+1\text{x}6) = 10$
$Q^2(B,2) = 1\ (0 + 1 \text{ x } 2) + 0\ (...) = 2$
$Q^2(B,3) = .5(2+1\text{x}2) + .5(4+(1*6)) = 7$

We also have to calculate for $V^2(A)$ and $V^2(B)$:
$V^2(A) \rightarrow max(Q^1(A,1), Q^1(A,2), Q^1(A,3)) \rightarrow 2$
$V^2(B) \rightarrow max(Q^1(B,1), Q^1(B,2), Q^1(B,3) \rightarrow 6$

$Q^1(A,1) = 0$
$Q^1(A,2) = 2$
$Q^1(A,3) = 0$
$Q^1(B,1) = 6$
$Q^1(B,2) = 0$
$Q^1(B,3) = 3$
$Q^2(A,1) = 6$
$Q^2(A,2) = 4$
$Q^2(A,3) = 4$
$Q^2(B,1) = 10$
$Q^2(B,2) = 2$
$Q^2(B,3) = 7$

1.2

The process: $\pi^{i+1}(s) = argmax_{a \in A} Q^i(S, a)$

$\pi^2(A) = argmax(Q^1(A,1), Q^1(A,2), Q^1(A,3)) \rightarrow argmax(0,2,0) \rightarrow 2$
$\pi^2(B) = argmax(6,0,3) \rightarrow 1$
$\pi^3(A) = argmax(6,4,4) \rightarrow 1$
$\pi^3(B) = argmax(Q^2(B,1), Q^2(B,2), Q^2(B,3)) \rightarrow argmax(10,2,7) \rightarrow 1$

2 Problem 2

$Q(S,A) = 4 * (1 - 0.8) + 0.8(Reward + DiscountFacotr + Max(Q(S, A_{next}))$

Q(S1,Up) = 4 * (1 - 0.8) + 0.8 *(0 + 0.3 * MaxQ(S,A)) → 0.8 + 0.8 * (0.3 * 8) → = .8 + .8 (.8 * 2.4) → 2.72

Q(S4, Right) = 8 * (1 - 0.8) + 0.8(0 + 0.3 * 16) → 1.6 + 3.84 → 5.44

Q(S5, Down) = 4 * (1 - .8) + .8 (0 + .3 * 10) → .8 + 2.4 → 3.2
Q(S2, Right) = 10 * (1 - .8) + .8(0 + .3 * 20) → 2 + 4.8 → 6.8

Q(S3, Up) = 20 * (1 - .8) + .8(20 + .3 * 0) → 4 + 16 → 20