Theory Question

Q1. Using $V(S) = \sum^{\max(a)} P(R + \gamma V_{s'})$

Iteration 1

$V(S_0) = \frac{1}{2}(1 + 0.9(0)) + 0.5(1 + 0.9 \times 0) = 1$

$V(S_1)$ (a) $\frac{1}{2}(2+0) + \frac{1}{2}(2+0) = 2.$

(b) $1(2+0) = 2.$

$V(S_2) = 1(3+0) = 3.$

$V(S_3) = 1 \times 10 = 10$

Iteration 2

$V(S_0) = \frac{1}{2}(1 + 0.9 \times 2) + \frac{1}{2}(0.9 \times 3 + 1) = 3.25$

$V(S_1) =$ (a) $\frac{1}{2}(2 + 0.9 \times 2) + \frac{1}{2}(2 + 0.9 \times 10) = 7.4$

(b) $2 + 0.9 \times 3 = 4.7.$

$V(S_2) = 3 + 0.9 = 3.9.$

$V(S_3) = 10 + 0.9 \times 10 = 19.$

Iteration 3

$V(S_0) = \frac{1}{2}(1 + 0.9 \times 7.4) + \frac{1}{2}(1 + 0.9 \times 3.9) = 3.8 + 2.2 = 6.08$

$V(S_1)$ (a) $\frac{1}{2}(2 + 0.9 \times 7.4) + \frac{1}{2}(2 + \underbrace{0.9 \times 19}_{9.55}) = 4.3 + 9.5 = 13.8$

(b) $2 + 0.9 \times 3.9 = 5.5.$

$V(S_2) = 3 + 0.9 \times 3.25 = 5.9$

$V(S_3) = 10 + 0.9 \times 19 = 27.1$

(b) For state S_1

Action 1 $\frac{1}{2}(2 + 0.9 \times 13.8) + 0.5(2 + 0.9 \times 27.1)$

$= 7.24 + 13.19 = 20.44$

Action 2 $= 1(2 + 0.9 \times 5.925) = 7.33.$

According to these results $\boxed{\text{Action 1}}$ will give us the optimal policy.

c) This is $\boxed{\text{False}}$. Suppose you have a cyclic Markov Decision Process then ~~ever~~ even if you take γ to be 0.5 after N iterations there will not be any convergence and it'll keep on the path

(ii) This is also $\boxed{\text{False}}$. Using $V(S) = R + \gamma \times S$. considering $P = 1$ In this case there can be no convergence.

(iii) $\boxed{\text{True}}$ Using $V(S) = R$ ~~and~~, similar case as (ii), no convergence, ∴ constant for each state.

Scanned by CamScanner

(IV) True, The markov Decision process is cyclic, there'll be a terminal state no matter what. After n-1 states a N iterations

False

(V) Noise is zero. since no stochastic actions. and ~~there~~ no ~~obs~~ absorbing goal states, it would not converge after N iterations.

Q2 Consider an image → n^2 pixels where each pigment is 8 bits. ⇒ Bits = 24 (total)

~~We~~ Given k clusters → k colors.

(If compressed data is being sent)

Resultant bits $= n^2(\log k)$

Compression Ratio $= \frac{24 \cancel{n^2}}{\cancel{n^2} \log k} = 24 (\log k)^{-1}$

We need 24k extra bits if we are considering the receiver as well. (decompressing data) ⇒ · Compression Ratio $= \frac{24 n^2}{n^2 \log k + 24k}$