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ML ASSIGNMENT 4

9(a) After 0th iteration:

$V(S_0) = 0$, $V(S_1) = 0$, $V(S_2) = 0$, $V(S_3) = 0$

After 1st iteration

$V(S_0) = 1$, $V(S_1) = 2$, $V(S_2) = 3$, $V(S_3) = 0$

After 2nd iteration:

$V(S_0) = 1 + (0.9 \times (0.5 \times 2) + 0.5 \times 3)$

$= 3.25$

$V(S_1) = 2 + 0.9(\max(0.5 \times 10 + 0.5 \times 2, 1 \times 3))$

$= 2 + 0.9(\max(6, 3)) = 2 + 0.9 \times 6$

$= 7.4$

$V(S_2) = 3 + 0.9 \times 1 \times 1$

$= 3.9$

$V(S_3) = 10 + 0.9 \times 1 \times 10$

$= 19$

After 3rd iteration

$V(S_0) = 3.25 + 0.9 \times (0.5 \times 7.4 + 0.5 \times 3.9)$

$= 8.335$

$V(S_1) = 7.4 + 0.9(\max(0.5 \times 19 + 0.5 \times 7.4, 1 \times 3.9))$

$= 19.28$

$V(S_2) = 3.9 + 0.9 \times 1 + 3.25$

$= 6.825$

$V(S_3) = 19 + 0.9 \times 1 \times 19$

$= 36.1$

(b) Optimal policy = π value at any possible actions of any possible state

The optimal policy is from $S_1 \rightarrow S_3$

$V(S_3) = 10 + 0.9\,(V(S_3))$

$0.1\,V^*(S_3) = 10$

$V^*(S_3) = 100$

$V^*(S_1) = 2 + 0.9\,(0.5\,V^*(S_1) + 0.5\,V^*(S_3))$

$V^*(S_1) = 2 + 0.9\,(0.5 * V^*(S_1) + 50)$

$V^*(S_1) = \frac{47}{0.55} = 85.45$

(c) (i) False, MDP isn't always cyclic

(ii) False, MDP isn't cyclic always so the value doesn't keep increasing and has no bounds.

(iii) True, values would be immediate rewards & there is no update.

(iv) True

(v) True

Q2 Each value = 0 - 255 → 2^8

8 bits for each value.

∴ each has R, G, B

thus 1 pixel = 3x8 = 24 = 3 bytes

whole image = $N^2 \times 24 = 24N^2$ bits = $3N^2$ bytes

If there are k clusters.

bits reqd ⇒ $2^b = k$

$b = \log_2 k$

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∴ total bits read ⇒ $3N^2 \times \log_2 k$

$= (3 \log_2 k) N^2$

compression ratio = $\frac{\text{uncompressed}}{\text{compressed}}$

$= \frac{24N^2}{3N^2 (\log_2 k)}$

$= \frac{8}{\log_2 k}$

⇒ It is prop to $\frac{1}{\log_2 k}$

⇒ higher the k higher the ratio.