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Assignment 4 - Theory
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Q1. (a) $V^1(s_0) = 1$
$V^1(s_1) = 2$
$V^1(s_2) = 3$
$V^1(s_3) = 10$

$V^2(s_0) = 1 + 0.9(0.5\times2 + 0.5\times3)$
$= 3.25$
$V^2(s_1) = \max(2 + 0.9(0.5\times2 + 0.5\times10),$
$2 + 0.9\times3)$
$= 7.4$
$V^2(s_2) = 3 + 0.9\times1 = 3.9$
$V^2(s_3) = 10 + 0.9\times10 = 19$

$V^3(s_0) = 1 + 0.9(0.5\times7.4 + 0.5\times3.9)$
$= 5.65$

$V^3(s_1) = \max(2 + 0.9(0.5\times7.4 + 0.5\times19),$
$2 + 0.9\times3.9)$
$= 13.88$

$V^3(s_2) = 3 + 0.9\times3.25$
$= 5.925$

$V^3(s_3) = 10 + 0.9\times19$
$= 27.1$

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(b) Optimal policy of state S_1 is to take action and go to state S_1 again.

(C) (i) False, this can't be determined as their can be multiple actions associated with a state and bcoz of which each state will not converge. in just one value iteration. Also, there can be cycles.

(ii) False, $\gamma=1$ can make the future rewards or the rewards that will be gathered later, more desirable, and will not let the state converge after 1 iteration.

(iii) True, all the converged values will be just immediate rewards.

(iv) True, since every state will converge within one iteration each, i.e. after every iteration ~~conver~~ atleast one state will reach optimality.

(v) False, without absorbing state, the value iteration will keep on changing the values of states, making it difficult for states to ~~eat~~ achieve convergence in N iterations.

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Q2. No. of bits to transmit image $= 3 \times 8 \times N^2$
$= \underline{24N^2}$

Now, using k-means we want to quantize the no. of colors ~~..~~ used in the image.
Originally we ~~..~~ have 2^{24} colors available for a image, i.e. we are storing this much types of different colors.
Now using k-means with optimal 'k' we are quantizing the colors to k colors.

To store values for these k colors, we just need $(\log_2 k)$ bits.

$\therefore$ Total bits required to transmit image $= (\log_2 k) \times N^2$

$$\text{Compression Ratio} = \frac{24 \times N^2}{\log_2 k \times N^2}$$

$$= \left(24 / \log_2 k\right)$$