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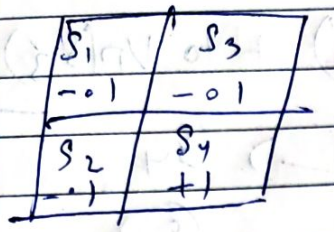
(1)

S_1	S_3
-0.1	-0.1
S_2	S_4
-1	+1

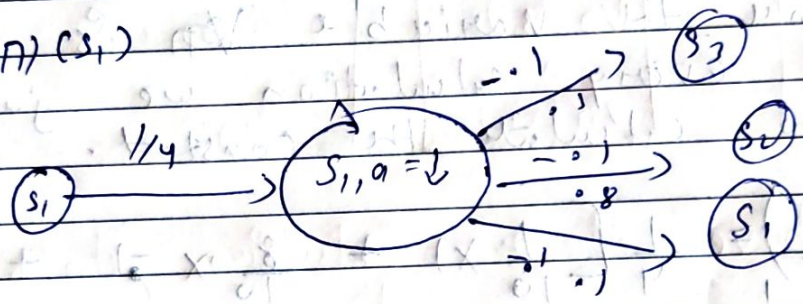


$A = \{\rightarrow, \leftarrow, \uparrow, \downarrow\}$

$\pi(a|s) = \frac{1}{4}$, s_0, s_1

find $V_\pi(S_1)$, $V_\pi(S_2)$, $V_\pi(S_3)$, $V_\pi(S_4)$

Sol^n $V(\pi)(S_1)$



$\downarrow$ $V_\pi(S_1)_1 = \frac{1}{4}\left[\frac{1}{10}(-0.1 + V_\pi(S_3)\right] + \frac{8}{10}(-0.1 + V_\pi(S_2)) + \frac{1}{10}(-0.1 + V_\pi(S_1))]$

$40 V_\pi(S_1) = -1 + V_\pi(S_3) + 8 V_\pi(S_2) + V_\pi(S_1)$

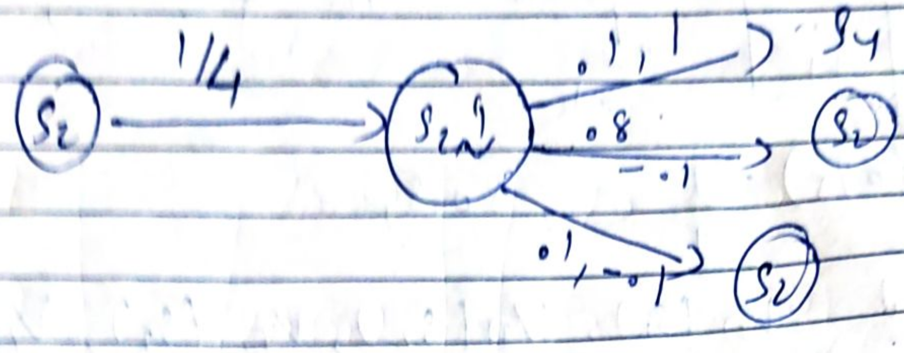
$\rightarrow$ $V_\pi(S_1)_2 = \frac{1}{4}\left[\frac{8}{10}(-0.1 + V_\pi(S_3)\right] + \frac{1}{10}(-0.1 + V_\pi S_2) + \frac{1}{10}(-0.1 + V_\pi$

$\leftarrow$ $V_\pi(S_1)_3 = \frac{1}{4}\left[\frac{8}{10}(-0.1) + V_\pi(S_1)\right] + \frac{1}{10}(-0.1) + V_\pi(S_1) + \frac{1}{10}(-0.1 + V_\pi(S_2))$

$\uparrow$ $\frac{1}{4}\left[\frac{9}{10}(-0.1 + V_\pi(S_1)) + \frac{1}{10}(-0.1) + V_\pi(S_3)\right.$

S_1	S_3
S_2	S_4

$$4 = -20 V_\pi(S_1) + 10 V_\pi(S_2) + 10 V_\pi(S_3) \quad \text{--- (1)}$$



Hence the variable V_π is same for every calculation we just have to calculate the constant.

$$\downarrow \; \text{Const}(V_\pi S_2)_1 = \frac{1}{4}\left[\frac{1}{10} \times 1 + \frac{8}{10} \times (-.1) + \frac{1}{10} \times (-.1)\right]$$

$$\rightarrow \; \text{Const}(V_\pi S_2)_2 = \frac{1}{4}\left[\frac{8}{10} \times 1 - \frac{1}{10} \times .1 - \frac{1}{10} \times .1\right]$$

$$\uparrow \; \text{Const}(V_\pi S_2)_3 = \frac{1}{4}\left[\frac{8}{10} \times (-.1) + \frac{1}{10} \times 1 + \frac{1}{10} \times (-.1)\right]$$

$$\leftarrow \; \text{Const}(V_\pi S_2)_3 = \frac{1}{4}\left[\frac{8}{10} \times (-.1) + \frac{1}{10} \times (-.1) + \frac{1}{10} \times (-.1)\right]$$

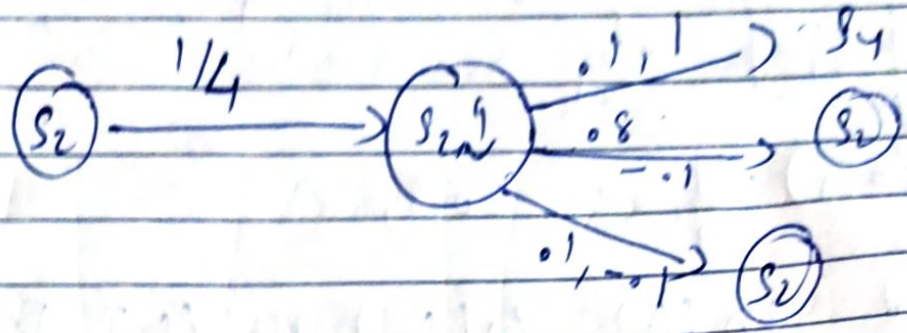
~~Const $(V_\pi S_2)$ ... -.3 ...~~

Final const = Const 1 + Const 2 + Const 3

+ Const 4.

S_1	S_3
S_2	S_4

$$4 = -20\,V_D(S_1) + 10\,V_D(S_2) + 10\,V_D(S_3) \quad \text{— (1)}$$



Hence the variable V_D is same for every calculation we just have to calculate the constant.

$$\text{Const}\,(V_D S_2)_1 = \frac{1}{4}\left[\frac{1}{10}\times 1 + \frac{8}{10}\times -1 + \frac{1}{10}\times(-1)\right]$$

$$\text{Const}\,(V_D S_2)_2 = \frac{1}{4}\left[\frac{8}{10}\times 1 - \frac{1}{10}\times 1 - \frac{1}{10}\times 1\right]$$

$$\text{Const}\,(V_D S_2)_3 = \frac{1}{4}\left[\frac{8}{13}\times(-.1) + \frac{8}{10}\times 1 + \frac{1}{10}\times(-1)\right]$$

$$\text{Const}\,(V_D S_3)_3 = \frac{1}{4}\left[\frac{8}{10}\times(-.1) + \frac{1}{10}\times(-.1) + \frac{1}{10}\times(-.1)\right]$$

~~Const $(V_D S_4)$ = 1(-.3) e.dp~~

Final const = Const 1 + Const 2 + Const 3

+ Const 4.

$$Cost = -20\sqrt{n}\,S_2 + 10\sqrt{n}\,S_1 + 10\sqrt{n}\,S_4$$

$$-7 = -20\sqrt{n}\,S_2 + 10\sqrt{n}\,S_1 + 10\sqrt{n}\,S_4 \quad -(2)$$

Here we can see that S_2 and S_3 are similar so we can write the equation as

$$-7 = -20\sqrt{n}\,S_3 + 10\sqrt{n}\,S_1 + 10\sqrt{n}\,S_4 \quad -(3)$$

For S_4.

Constant = Const ↑ + const ↓ + Cost → + Const ←

$$Cost\uparrow = \frac{1}{4}\left(\frac{8}{10}\times(-1) + \frac{1}{10}\times(-1) + \frac{1}{10}(\cdot 1)\right)$$

$$cost\downarrow = \frac{1}{4}\left[\frac{8}{10}\times 1 + \frac{1}{10}\times 1 - \frac{1}{10}(\cdot 1)\right)$$

$$Cost(\leftarrow) = \frac{1}{4}\left(\frac{8}{10}\times(-1) + \frac{1}{10}\times(-1) + \frac{1}{10}\times 1\right)$$

$$Cost(\rightarrow) = \frac{1}{4}\left(\frac{8}{10}\times 1 + \frac{1}{10}(-1) + \frac{1}{10}\times 1\right)$$

$$-18 = -20\sqrt{n}\,S_4 + 10\sqrt{n}\,S_2 + 10\sqrt{n}\,S_3 \quad -(4)$$

From eq^{n} (1) (2) (3) and (4) we can write as

$$\begin{bmatrix} 4 \\ -7 \\ -7 \\ -18 \end{bmatrix} = \begin{bmatrix} V_n(s_1) \\ V_n(s_2) \\ V_n(s_3) \\ V_n(s_4) \end{bmatrix} \begin{bmatrix} -20 & 10 & 10 & 0 \\ 10 & -20 & 0 & 10 \\ 10 & 0 & -20 & 10 \\ 0 & 10 & 10 & -20 \end{bmatrix}$$

Above Matrix Solution does not exist.