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BEATRIZ U. ASUNCION

Exercise #3

$R_{school} = \begin{bmatrix} 5 \\ 3 \end{bmatrix}$ $R_{stay} = \begin{bmatrix} -5 \\ 1 \end{bmatrix}$

Step 1:

For Sunny:

$r_\pi = 0.5(5) + 0.5(-5) = 2.5 + (-2.5) = 0$

For Cloudy:

$r_\pi = 0.5(3) + 0.5(1) = 1.5 + 0.5 = 2$

$r_\pi = \begin{bmatrix} 0 \\ 2 \end{bmatrix}$

Step 2:

Row 1 (Sunny):

- $P_\pi(1,1) = 0.5(0.8) + 0.5(0.9) = 0.4 + 0.45 = 0.85$
- $P_\pi(1,2) = 0.5(0.2) + 0.5(0.1) = 0.1 + 0.05 = 0.15$

Row 2 (Cloudy):

- $P_\pi(2,1) = 0.5(0.4) + 0.5(0.3) = 0.2 + 0.15 = 0.35$
- $P_\pi(2,2) = 0.5(0.6) + 0.5(0.7) = 0.3 + 0.35 = 0.65$

$r_\pi = \begin{bmatrix} 0.85 & 0.15 \\ 0.35 & 0.65 \end{bmatrix}$

Step 3: (Sunny)

$v_1 = 0 + 0.9(0.85v_1 + 0.15v_2)$

$v_1 = 0 + 0.765v_1 + 0.135v_2$

$v_1 = 0.765v_1 - 0.135v_2 = 0$

$= 0.235v_1 - 0.135v_2 = 0$

Step 3: (Cloudy)

$v_2 = 2 + 0.9(0.35v_1 + 0.65v_2)$

$v_2 = 2 + 0.315v_1 + 0.585v_2$

$v_2 = -0.315 - 0.585 = 2$

$= -0.315v_1 + 0.415v_2 = 2$

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Step 4:

Cloudy

$0.235v_1 - 0.135 = 0$

$0.235v_1 = 0 + 0.135v_2$

$\frac{0.235v_1}{0.235} = \frac{0+0.135v_2}{0.235}$

$\boxed{v_1 = \frac{0+0.135v_2}{0.235}}$

$-0.315v_1 + 0.415v_2 = 2$

$-0.315\left(\frac{0+135v_2}{0.235}\right) + 0.415v_2 = 2$

$\left(-0.135\frac{0}{0.235}\right)\left(-0.135 \times \frac{0.135}{0.235v_2}\right) + 0.415 = 2$

$(-0.135 \times 0)(-0.135 \times 0.574v_2) + 0.415v_2 = 2$

$0 - 0.181v_2 + 0.415v_2 = 2$

$0 + 0.234v_2 = 2 + 0$

$0.234v_2 = 2 + 0$

$\boxed{v_T\,(\text{Cloudy}) = \frac{2+0}{0.234} = \frac{2}{0.234} = 8.547}$

Sunny

$v_1 = \frac{0+0.135v_2}{0.235}$

$v_1 = \frac{0+0.135(8.547)}{0.235} = \frac{0+1.154}{0.235} = \frac{1.154}{0.235}$

$\boxed{v_T\,(\text{Sunny}) = 4.911}$

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Step 5:

For Sunny (v_1) using school:

$v_*(\text{sunny}) = 5 + 0.9(0.8v_1 + 0.2v_2)$

$v_1 = 5 + 0.72v_1 + 0.18v_2$

$v_1 = 0.72 - 0.18v_2 = 5$

$\boxed{0.28v_1 = 0.18v_2 = 5}$

For Cloudy (v_2) using School:

$v_*(\text{cloudy}) = 3 + 0.9(0.4v_1 + 0.6v_2)$

$v_2 = 3 + 0.36v_1 + 0.59v_2$

$V_2 = -0.36v_1 - 0.59v_2 = 3$

$\boxed{-0.36v_1 + 0.46v_2 = 3}$

Step 6:

From Sunny: $0.28v_1 = 5 + 0.18v_2$

$v_1 = \dfrac{5 + 0.18v_2}{0.28}$

From Cloudy: $-0.36v_1 + 0.46v_2 = 3$

$-0.36\left(\dfrac{5 + 0.18v_2}{0.28}\right) + 0.46v_2 = 3$

Step 6 (cloudy):

$-0.36\left(\dfrac{5 + 0.18v_2}{0.28}\right) + 0.46v_2 = 3$

$\left(-0.36 \times \dfrac{5}{0.28}\right)\left(-0.36 \times \dfrac{0.18v_2}{0.28}\right) + 0.46v_2 = 3$

$-6.429 - 0.231v_1 + 0.46v_2 = 3$

$-6.429 + 0.229v_2 = 3$

$0.229v_2 = 3 + 6.429$

$0.229v_2 = 9.429$

$\boxed{v_*(\text{cloudy}) = \dfrac{9.429}{0.229} = 41.175}$

Sunny:

$v_1 = \dfrac{5 + 0.18v_2}{0.28}$

$v_1 = \dfrac{5 + 0.18(41.175}{0.28}$

$v_1 = \dfrac{5 + 7.412}{0.28} = \dfrac{12.412}{0.28}$

$\boxed{v_*(\text{sunny}) = 44.329}$

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Step 1:

$q(1, \text{School}) = 5 + 0.9(0.8v_1 + 0.2v_2) = 44.33$

$q(1, \text{Home}) = -5 + 0.9(0.9v_1 + 0.1v_2) = 34.61$

$q(2, \text{School}) = 3 + 0.9(0.4v_1 + 0.6v_2) = 41.18$

$q(2, \text{Home}) = 1 + 0.9[0.3v_1 + 0.7v_2) = 38.91$