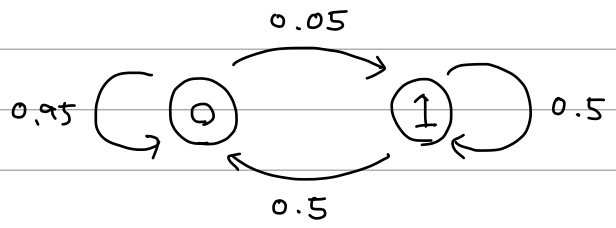
DATE : . . .

2. 1) $X_t = \begin{cases} 0 & \text{if up} \\ 1 & \text{if down} \end{cases}$

$P_{00} = P\{X_{t+1}=0 \mid X_t=0\} = 0.95$
$P_{01} = P\{X_{t+1}=1 \mid X_t=0\} = 0.05$
$P_{10} = P\{X_{t+1}=0 \mid X_t=1\} = 0.5$
$P_{11} = P\{X_{t+1}=1 \mid X_t=1\} = 0.5$

$$\therefore P = \begin{array}{c} \text{State} \\ 0 \\ 1 \end{array} \begin{array}{c} \begin{array}{cc} 0 & 1 \end{array} \\ \begin{bmatrix} 0.95 & 0.05 \\ 0.5 & 0.5 \end{bmatrix} \end{array}$$



2) $(\pi_0, \pi_1) = (\pi_0, \pi_1) \cdot P$ and $\sum_{j=0}^{1} \pi_j = 1$

$$(\pi_0, \pi_1) = (\pi_0, \pi_1) \cdot \begin{bmatrix} 0.95 & 0.05 \\ 0.5 & 0.5 \end{bmatrix}$$

$$\begin{cases} \pi_0 = 0.95\pi_0 + 0.5\pi_1 \\ \pi_1 = 0.05\pi_0 + 0.5\pi_1 \\ 1 = \pi_0 + \pi_1 \end{cases}$$

$$\Downarrow$$

$$\begin{cases} -0.05\pi_0 + 0.5\pi_1 = 0 \\ \pi_0 + \pi_1 = 1 \end{cases}$$

$$A = \begin{bmatrix} -0.05 & 0.5 \\ 1 & 1 \end{bmatrix}, \quad x = \begin{bmatrix} \pi_0 \\ \pi_1 \end{bmatrix}, \quad b = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

$$A \cdot x = b \Rightarrow x = A^{-1} \cdot b = \begin{bmatrix} 0.909091 \\ 0.090909 \end{bmatrix}$$

$\pi_0 = 0.909091$, $\pi_1 = 0.090909$