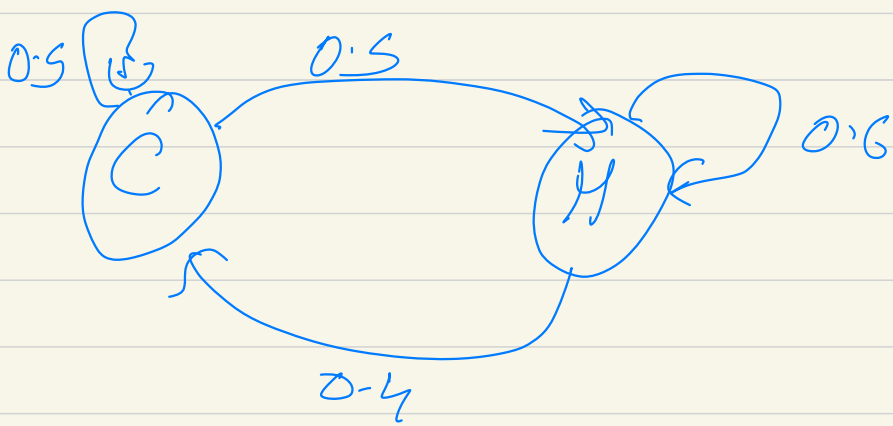
# Viterbi Algorithm

$P(V_1, V_2, V_3 \dots V_T, S_T)$

↳ Probability of getting the observation sequence $V_1, V_2 \dots V_T$ & landing at $S_T$




$$A = \begin{array}{c} \\ C \\ H \end{array} \begin{array}{c} \begin{array}{cc} C & H \end{array} \\ \begin{bmatrix} 0.5 & 0.5 \\ 0.4 & 0.6 \end{bmatrix} \end{array}$$

$$B = \begin{array}{c} \\ C \\ H \end{array} \begin{array}{c} \begin{array}{ccc} 1 & 2 & 3 \end{array} \\ \begin{bmatrix} 0.5 & 0.4 & 0.1 \\ 0.2 & 0.4 & 0.4 \end{bmatrix} \end{array}$$

$$\pi = \begin{array}{c} \begin{array}{cc} C & H \end{array} \\ \begin{bmatrix} 0.2 & 0.8 \end{bmatrix} \end{array}$$

Seq = 3 1 3

Seq = M C M → Ans

$P(3|C) = 0.1$

$P(3|M) = 0.4$

| | 3(1) | 1(2) | 3(3) |
|---|---|---|---|
| C | 0 | M | C |
| M | 0 | M | C |

$P(C)\,P(3|C) = F_1(C)$

$P(M)\,P(3|M) = F_1(M)$

| | 3(1) | 1(2) | 3(3) |
|---|---|---|---|
| C | 0.02 | 0.064 | 0.0032 |
| M | 0.32 | 0.0384 | 0.0128 |

$F_2(C)$ :

$\max(0.02 \times 0.5 \times 0.5,\ 0.32 \times 0.4 \times 0.5)$

$F_2(M) \rightarrow \max(0.02 \times 0.5 \times 0.2,\ 0.32 \times 0.6 \times 0.2)$

$F_3(C) = \max(0.064 \times 0.5 \times 0.1,\ 0.0384 \times 0.4 \times 0.1)$ (0.0032, 0.0015)

$F_3(M) = \max(0.064 \times 0.5 \times 0.4,\ 0.0384 \times 0.6 \times 0.4)$ (0.0128, 0.00922)

Most likely sequence = HCH