

Problem 4.10

$$P = \begin{matrix} & C & S & G \\ \begin{matrix} C \\ S \\ G \end{matrix} & \begin{pmatrix} 0.5 & 0.4 & 0.1 \\ 0.3 & 0.4 & 0.3 \\ 0.2 & 0.3 & 0.5 \end{pmatrix} \end{matrix}$$

$P(\text{Gary not in gloom mode on three following days} \mid \text{cheerful mood})$

$C \Rightarrow S$
 $G = \text{it}$

Q? W_n ? $Q_{ij} = P_{ij} \quad i, j \in G$
 $Q_{iA} = P_{iG} \quad i \in C, i \in S$
 $Q_{AA} = 1$

$$Q = \begin{matrix} & C & S & A \\ \begin{matrix} C \\ S \\ A \end{matrix} & \begin{pmatrix} 0.5 & 0.4 & 0.1 \\ 0.3 & 0.4 & 0.3 \\ 0 & 0 & 1 \end{pmatrix} \end{matrix}$$

$P(X_n \neq G, n=1,2,3 \mid X_0=C)$
 $= P(W_3=C \mid W_0=C) + P(W_3=S \mid W_0=C)$
 $= Q_{CC}^3 + Q_{CS}^3 = 0.293 + 0.212 \cdot 0.585$

jan. 28-10:33

Ex 11 Gary gloom four days ago
 Given he has not been cheerful for a week. What is the probability he is gloom today

$$P = P(X_3=C \mid X_2, X_1, X_0 \neq C, X_4=2, X_3, X_2, X_1 \neq C)$$

$$= P(X_0=2, X_1, X_0, X_5 \neq C, X_1=2, X_0, X_1, X_2 \neq C) / P(X_1, X_0, X_5 \neq C, X_1=2, X_0, X_1, X_2 \neq C)$$

$$= P(X_0=2, X_1, X_0, X_5 \neq C \mid X_1=2) / P(X_1, X_0, X_5 \neq C \mid X_1=2)$$

$$= \frac{P(X_1=2, X_2, X_1, X_3 \neq C \mid X_0=2)}{P(X_1, X_0, X_1 \neq C \mid X_0=2)}$$

$$= \frac{Q_{22}^4}{Q_{22}^3 + Q_{21}^2} = \frac{0.1885}{0.210 + 0.281} = 0.409$$

jan. 28-10:46

Ex 4.7 expanded Markov chain

$P(\text{rain tomorrow} \mid \text{not rained yesterday or day before})$

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 DDRR, DD DR RR

jan. 28-11:00