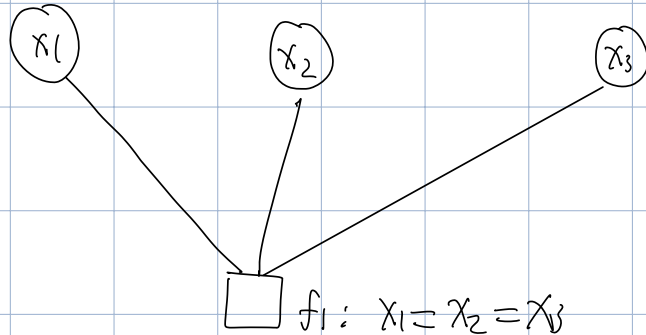


Please show a few steps of iterations of message passing.

(1) $S_1=18 \quad N_1=20 \quad S_2=22 \quad N_2=20 \quad S_3=29 \quad N_3=30$



$P_{\theta}^{\text{true}} \quad x_i \sim \text{Bern}(u_i) \quad u_i \sim \text{Beta}(S_i, N_i)$

① $S_1=18 \quad N_1=20 \quad S_2=22 \quad N_2=20 \quad S_3=29 \quad N_3=30$

② $f_1 \rightarrow x_1: \begin{matrix} x_1 \leq x_2 \\ x_1 \leq x_3 \end{matrix} \therefore S_1=51 \quad N_1=50$

$f_1 \rightarrow x_2: \begin{matrix} x_2 \leq x_1 \\ x_2 \leq x_3 \end{matrix} \therefore S_2=47 \quad N_2=50$

$f_1 \rightarrow x_3: \begin{matrix} x_3 \leq x_1 \\ x_3 \leq x_2 \end{matrix} \therefore S_3=40 \quad N_3=40$

③ $S_1=69 \quad N_1=70 \quad S_2=69 \quad N_2=70 \quad S_3=69 \quad N_3=70$

此时已收敛，这个结果是 x_1, x_2, x_3 参数 u_1, u_2, u_3 的后验分布。

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(2)

$N(m_1, \Sigma_1)$

$N(m_2, \Sigma_2)$

x_1

x_2

$f(x_1 = x_2)$

① $x_1 \sim N(m_1, \Sigma_1)$ $x_2 \sim N(m_2, \Sigma_2)$

② $f_1: \hat{\Sigma}_1^{-1} = \hat{\Sigma}_2^{-1} \quad \hat{\Sigma}_1^{-1} \hat{m}_1 = \hat{\Sigma}_2^{-1} m_2$

$f_1: \hat{\Sigma}_2^{-1} = \hat{\Sigma}_1^{-1} \quad \hat{\Sigma}_2^{-1} \hat{m}_2 = \hat{\Sigma}_1^{-1} m_1$

③ $\hat{\Sigma}_2^{-1} = \hat{\Sigma}_1^{-1} = \hat{\Sigma}_1^{-1} + \hat{\Sigma}_2^{-1}$

$$\hat{\Sigma}_2^{-1} \hat{m}_2 = \hat{\Sigma}_1^{-1} \hat{m}_1 = \hat{\Sigma}_1^{-1} m_1 + \hat{\Sigma}_2^{-1} m_2$$