

TODO

$$\begin{aligned}
 p(X = x, \Psi, k | Y = y) &\propto \\
 &\frac{1}{\sqrt{2\pi\sigma_{x_s}^2}} \exp \left\{ -\frac{1}{2} \sum_{s \in \Omega} \left( \frac{y_s - \mu_{x_s}}{\sigma_{x_s}} \right)^2 \right\} \\
 &\times \frac{\exp \left\{ -\sum_{s \in \Omega} \left( \beta_{x_s}^{(0)} + \beta^{(1)} V(x_s, \eta_s) \right) \right\}}{\prod_{s \in \Omega} \sum_{c \in \Lambda} \exp \left\{ -\left( \beta_c^{(0)} + \beta^{(1)} V(c, \eta_s) \right) \right\}} \\
 &\times p_r \left( \beta^{(1)} \right) p_r(k) \prod_{c \in \Lambda} p_r(\mu_c) p_r(\sigma_c) p_r \left( \beta_c^{(0)} \right)
 \end{aligned} \tag{1}$$

$$\begin{aligned}
 p(x_s = c | y_s, \eta_c, \Psi_c) &\propto \\
 &\frac{1}{\sqrt{2\pi\sigma_c^2 T_t}} \exp \left\{ -\frac{1}{T_t} \left[ \frac{1}{2} \left( \frac{y_s - \mu_c}{\sigma_c} \right)^2 + \left( \beta_c^{(0)} + \beta^{(1)} V(c, \eta_s) \right) \right] \right\}
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 p(\mu_c, \sigma_c | Y, X) &\propto \prod_{s: x_s = c} p(y_s | \mu_c, \sigma_c) p_r(\mu_c) p_r(\sigma_c) \\
 &= \frac{1}{\sigma_c (2\pi\sigma_c^2 T_t)^{n_c}} \exp \left\{ -\frac{1}{2T_t} \sum_{s: a_s = c} \left( \frac{y_s - \mu_c}{\sigma_c} \right)^2 \right\}
 \end{aligned} \tag{3}$$

$$\begin{aligned}
 p(\beta_c^{(0)}, c \in \Lambda | X) &= p(X | \beta_c^{(0)}, c \in \Lambda) p_r(\beta_c^{(0)}, c \in \Lambda) \\
 &= \prod_{(c \in \Lambda, \psi_\eta)} \left( \frac{\exp(-\frac{1}{T_t} [\beta_c^{(0)} + \beta^{(1)} V(c, \eta)])}{\sum_{i \in \Lambda} \exp(-\frac{1}{T_t} [\beta_i^{(0)} + \beta^{(1)} V(i, \eta)])} \right)^{n_{(c, n)}} \\
 &= \prod_{(c \in \Lambda)} \left( \frac{\exp(-\frac{1}{T_t} [\beta_c^{(0)}])}{\sum_{i \in \Lambda} \exp(-\frac{1}{T_t} [\beta_i^{(0)}])} \right)^{n_c} \\
 &\times \prod_{(c \in \Lambda, \psi_\eta)} \left( \frac{\exp(-\frac{1}{T_t} [\beta^{(1)} V(c, \eta)]) \sum_{i \in \Lambda} \exp(-\frac{1}{T_t} [\beta_i^{(0)}])}{\sum_{i \in \Lambda} \exp(-\frac{1}{T_t} [\beta_i^{(0)} + \beta^{(1)} V(i, \eta)])} \right)^{n_{(c, n)}}
 \end{aligned} \tag{4}$$

$$\begin{aligned}
 \beta_{c1}^{(0)} &= \beta_c^{(0)} - T_t \ln(u_1) & \beta_{c2}^{(0)} &= \beta_c^{(0)} - T_t \ln(1 - u_1) \\
 \mu_{c1} &= \mu_c - u_2 \sigma_c \sqrt{\frac{1-u_1}{u_1}} & \mu_{c2} &= \mu_c + u_2 \sigma_c \sqrt{\frac{u_1}{1-u_1}} \\
 \sigma_{c1}^2 &= u_3 (1 - u_2^2) \sigma_c^2 \frac{1}{u_1} & \sigma_{c2}^2 &= (1 - u_3) (1 - u_2^2) \sigma_c^2 \frac{1}{1-u_1}
 \end{aligned} \tag{5}$$