

# Технический слайд ( $\leq 12.5$ min)

На доске вывод основной формулы + conditional conj.

$$\begin{aligned} \sum_x \prod_i q_i(x_i) \log \frac{\prod_i q_i(x_i)}{p(x)} &= \sum_{x_j} \sum_{x_{-j}} q_j(x_j) \prod_{i \neq j} q_i(x_i) \left[ \sum_k \log q_k(x_k) - \log p(x) \right] = \\ &= \sum_{x_j} q_j(x_j) \sum_{x_{-j}} \prod_{i \neq j} q_i(x_i) \left[ \sum_{k \neq j} \log q_k(x_k) + \log q_j(x_j) \right] - \sum_{x_j} q_j(x_j) \sum_{x_{-j}} \prod_{i \neq j} q_i(x_i) \log p(x) = \\ &= \sum_{x_j} q_j(x_j) \sum_{x_{-j}} \prod_{i \neq j} q_i(x_i) \log q_j(x_j) - \sum_{x_j} q_j(x_j) \mathbb{E}_{x_{-j}} \log p(x) + \text{const} = \\ &= \sum_{x_j} q_j(x_j) \left[ \log q_j(x_j) - \mathbb{E}_{x_{-j}} \log p(x) \right] \xrightarrow{+ \text{const}} \min_{q_j(x_j)} \end{aligned}$$

$$\log q_j(x_j) = \mathbb{E}_{x_{-j}} \log p(x) + \text{const.}$$

$$q_j(x_j) = \frac{1}{Z} \cdot \exp(\mathbb{E}_{x_{-j}} \log p(x))$$

