Mean Field for LDA (week 3)

$$\log q(Z) = \mathbb{E}_{q(\Theta)} \log p(\Theta, Z, W) + \text{const}$$

$$= \mathbb{E}_{q(\Theta)} \sum_{d=1}^{D} \sum_{t=1}^{T} (\alpha - 1) \log \theta_{dt} + \text{const}$$

$$+ \mathbb{E}_{q(\Theta)} \sum_{d=1}^{D} \sum_{n=1}^{N_d} \sum_{t=1}^{T} [z_{d_n} = 1] (\log \theta_{dt} + \log \phi_{t w_{dn}})$$

$$= \sum_{d=1}^{D} \sum_{n=1}^{N_d} \sum_{t=1}^{T} [z_{d_n} = 1] \left(\mathbb{E}_{q(\Theta)} \log \theta_{dt} + \log \phi_{t w_{dn}} \right)$$

$$+ \text{const}$$

$$q(Z) = \prod_{d=1}^{D} q(z_d) = \ldots$$