Exercise: Derivation of the structured mean field updates for FHMM

Derive the updates below for the structured mean field approximation for factorial HMMs:

$$\boldsymbol{\xi}_{tm} = \exp\left(\mathbf{W}_m^\top \boldsymbol{\Sigma}^{-1} \tilde{\mathbf{x}}_{tm} - 1/2\boldsymbol{\delta}_m\right) \tag{1}$$

$$\boldsymbol{\delta}_m \triangleq \mathrm{diag}(\mathbf{W}_m^\top \boldsymbol{\Sigma}^{-1} \mathbf{W}_m) \tag{2}$$

$$\tilde{\mathbf{x}}_{tm} \triangleq \mathbf{x}_t - \sum_{\ell \neq m}^{M} \mathbf{W}_\ell \mathbb{E}\left[\mathbf{z}_{t,\ell}\right] \tag{3}$$