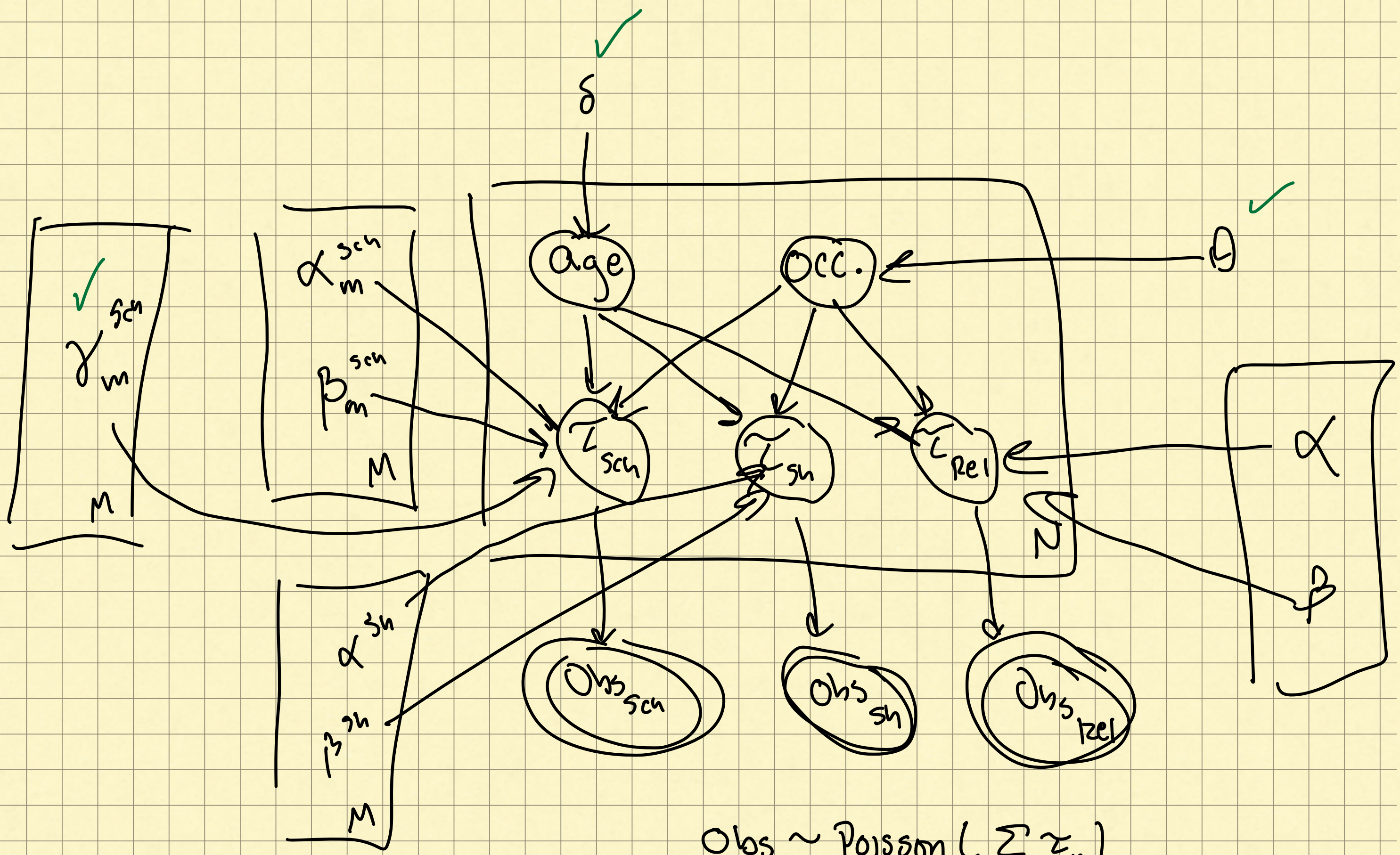


$$Obs \sim \text{Poisson}(\underbrace{\textstyle\sum_n \tau_n}_{\lambda})$$

$$\alpha^*, \beta^* = \underset{\alpha, \beta}{\arg\max} \log p(Obs \mid \alpha, \beta)$$

→ Stochastic Variational (BBVI)

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Aside: Variational inference

$$\log p(Obs \mid \alpha, \beta)$$

$$= \log \underbrace{\sum_{age} \sum_{occ} \sum_{\tau}}_{\text{Exponential}} p(\tau, age, occ, Obs \mid \alpha, \beta)$$

$$\geq \max_q -KL(q \,\|\, p(\tau, age, occ, Obs \mid \alpha, \beta))$$

$$q(\tau, \text{age}, \text{occ}) = \prod_{n=1}^{N} q(\tau_n ; \phi_n)\, q(\text{age} ; \psi_n)\, q(\text{occ} ; \nu_n)$$

$$\geq \max_{\phi_n, \psi_n, \nu_n} -KL\left( q(\cdot \mid \phi, \psi, \nu) \,\|\, p(\cdot) \right)$$

"solved" by

stochastic VI

$q(\tau_n) \rightarrow \hat{\lambda}$

$$\left.\begin{array}{l} \text{BetaBinomial}(\tau_1 \mid a_1, b_1, z_1) \\ \text{BetaBinomial}(\tau_2 \mid a_2, b_2, z_2) \\ \vdots \\ \text{BetaBinomial}(\tau_N \mid a_N, b_N, z_N) \end{array}\right\} \rightarrow \hat{\lambda}$$