Multinomial likelihood

$$P(X|\theta) = \frac{n!}{x_1!\ldots x_K!}\theta_1^{x_1}\ldots\theta_K^{x_K}$$

$$p(\theta) = \mathrm{Dir}(\theta|\alpha) = \frac{1}{B(\alpha)}\prod_{k=1}^{K}\theta_k^{\alpha_k-1}$$

$$p(\theta|X) \propto \prod_{k=1}^{K}\theta_k^{\alpha_k+x_k-1}$$

$$p(\theta|X) = \mathrm{Dir}(\theta|\left(\begin{array}{c}\cdots\\ \alpha_k+x_k\\ \cdots\end{array}\right))$$