$$\begin{aligned}
\pi(y_1, \ldots, y_N, \theta) &= \left[\prod_{n=1}^{N} \pi(y_n \mid p(\theta))\right] \cdot \pi(\theta) \\
&= \left[\prod_{n=1}^{N} \mathrm{Bernoulli}(y_n \mid p(\theta))\right] \cdot \pi(\theta)
\end{aligned}$$