Beta prior

$$p(X|\theta) = \theta^{N_1}(1-\theta)^{N_0}$$

$$p(\theta) = B(\theta|a,b) \propto \theta^{a-1}(1-\theta)^{b-1}$$

$$p(\theta|X) \propto p(X|\theta)p(\theta)$$

$$p(\theta|X) \propto \theta^{N_1}(1-\theta)^{N_0} \cdot \theta^{a-1}(1-\theta)^{b-1}$$

$$p(\theta|X) \propto \theta^{N_1+a-1}(1-\theta)^{N_0+b-1}$$

$$p(\theta|X) = B(N_1+a, N_0+b)$$