HW 3.

Q 3.

Multinomial - Dirichlet Model Posterior Derivation.

$$P(x|\theta) = \frac{n!}{x_1! \cdots x_k!} \prod_{k=1}^{k} \theta_k^{x_k}$$

$$P(\theta) = \frac{1}{B(a)} \prod_{k=1}^{k} \theta_k^{a_k - 1}$$

$\Rightarrow P(\theta|x) \propto \prod_{k=1}^{k} \theta^{x_k + a_k - 1}$ by Baye's theorem.

$\Rightarrow \theta|x \sim$ Dirichlet $(a_1 + x_1, a_2 + x_2, \ldots, a_k + x_k)$