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DSC 465: Intermediate Statistics
Assignment #2
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Q1:

$$\pi(\theta | x) = \frac{f(x|\theta) \pi(\theta)}{\int_{\theta=0}^1 f(x|\theta) \pi(\theta) d\theta} = \frac{f(x|\theta) \pi(\theta)}{\sum_{\theta} f(x|\theta) \pi(\theta)}$$

posterior

$$f(x|\theta) = \binom{n}{x} \theta^x (1-\theta)^{n-x}$$

$$\Rightarrow \pi(\theta | x) = \frac{\cancel{\binom{n}{x}} \theta^x (1-\theta)^{n-x} \cancel{\pi(\theta)}}{\sum_{\theta} \cancel{\binom{n}{x}} \theta^x (1-\theta)^{n-x} \cancel{\pi(\theta)}}$$

$$\theta\left(\frac{1}{4}, \frac{1}{2}, \frac{3}{4}\right) = \frac{1}{3}$$

$$\pi(\theta | x) = \frac{\theta^x (1-\theta)^{n-x}}{\left(\frac{1}{4}\right)^4 \left(\frac{3}{4}\right)^6 + \left(\frac{1}{2}\right)^4 \left(\frac{1}{2}\right)^6 + \left(\frac{3}{4}\right)^4 \left(\frac{1}{4}\right)^6}$$

$$\pi(\theta | x) = \begin{cases} .397 & \text{for } \theta = \frac{1}{4} \\ .558 & \text{for } \theta = \frac{1}{2} \\ .044 & \text{for } \theta = \frac{3}{4} \end{cases}$$