## Previously on MA40189:

- using the posterior for inference: region that captures most of the values of $\theta$ (assumed univariate)
- credible interval $(\theta_L, \theta_U)$ is an interval within which $100(1-\alpha)\%$ of the posterior distribution lies

$$P(\theta_L < \theta < \theta_U \,|\, x) \;=\; 1-\alpha$$

## Today on MA40189:

- highest density region $C$ such that $P(\theta \in C \,|\, x){=}1-\alpha$ and if $\theta_1 \in C, \theta_2 \notin C$

$$f(\theta_1 \,|\, x) \;\geq\; f(\theta_2 \,|\, x)$$

- HDRs difficult to compute but may be more meaningful for multimodal distributions
- prediction about future observations of data

$$\begin{aligned} f(z \,|\, x) &= \int_\theta f(z \,|\, x, \theta) f(\theta \,|\, x)\, d\theta \\ &= \int_\theta f(z \,|\, \theta) f(\theta \,|\, x)\, d\theta \end{aligned}$$

  if $X$ and $Z$ are conditionally independent given $\theta$

- example of Binomial-Beta distribution
  - prior for $\theta \sim Beta(\alpha, \beta)$
  - observations, $X \,|\, \theta \sim Bin(n, \theta)$, $Z \,|\, \theta \sim Bin(m, \theta)$
  - distribution of $Z \,|\, x$ is Binomial-Beta.