Previously on MA40189:

- statistical decision problem: $[\Theta, \mathcal{D}, \pi(\theta), L(\theta, d)]$
  - solve $[\Theta, \mathcal{D}, f(\theta), L(\theta, d)]$ for immediate decision
  - solve $[\Theta, \mathcal{D}, f(\theta \,|\, x), L(\theta, d)]$ for decision having observed the sample x
- Bayes risk $\rho^*(\pi)$ minimises expected loss

$$\rho(\pi, d) \;=\; \int_\theta L(\theta, d)\pi(\theta)\, d\theta$$

- Bayes rule d^* decision which achieves Bayes risk
- risk of the sampling procedure is

$$\rho_n^* \;=\; E[E\{L(\theta, \delta^*(x)) \,|\, X\}]$$

- Example: estimate the parameter, θ, of a Poisson dist
  - ∘ $L(\theta, d) = \theta(\theta - d)^2$
  - ∘ $\theta \sim Gamma(\alpha, \beta)$, $X_i \,|\, \theta \sim Po(\theta)$

Today on MA40189:

- solving $[\Theta, \mathcal{D}, \pi(\theta), L(\theta, d)]$ we find that

$$d^* = \frac{E_{(\pi)}(\theta^2)}{E_{(\pi)}(\theta)};\;\; \rho^*(\pi) = E_{(\pi)}(\theta^3) - \frac{E^2_{(\pi)}(\theta^2)}{E_{(\pi)}(\theta)}$$

- solve the immediate decision, posterior decision, the risk of the sampling procedure and look at choosing the optimal sample size.