Lecture 12A
MTH6102: Bayesian Statistical Methods

Eftychia Solea

Queen Mary University of London

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Today's agenda

Today's lecture

- Examinable topics
- Work through the past exam papers

Final exam

- The final exam is on **9th of January, Tuesday**.
- Closed-book, but you are allowed to bring three A4 sheets of paper (i.e., 6 faces in total) as notes for the exam.
- Only approved non-programmable calculators are permitted in this examination.

Final exam

- Exam same form with past exams.
- Open-problem questions that require fully-reasoned, convincing answers for full marks.
- Partial credit is possible and reaching a correct conclusion does not guarantee full credit on these questions.

Office hours

- Extra two online office hours on Teams during examination period, TBA
- Two office hours on 8th of January, 10-12am in my office MB324

Examinable topics

The final exam covers the following material

- **Topic 1: Likelihood**
  - Likelihood function and log likelihood function
  - Maximum likelihood estimates
  - **non-examinable:** standard error, sampling distribution, confidence intervals

Examinable topics

- **Topic 2: Bayes' theorem and Bayesian updating**

  Bayes' theorem

$$p(\theta \mid y) = \frac{p(\theta)\, p(y \mid \theta)}{p(y)} = \frac{\text{prior} \times \text{likelihood}}{P(\text{data})}$$

  - Discrete parameter θ/discrete data y
  - Continuous parameter θ/discrete data y, e.g., beta/binomial etc
  - Continuous parameter θ/continuous data y, e.g., normal/normal etc

Examinable topics

- **Topic 3: Conjugate priors**
- **Topic 4: Point estimates and credible intervals**
  - Compute Bayes point estimates (posterior mean, median) given posterior pmf or pdf distribution.
  - Construct equal-tail credible intervals given a posterior pmf or pdf distribution.
  - Transformed parameters and multiple parameters
  - **non-examinable**: HPD interval for non-symmetric distributions.

Examinable topics

- **Topic 5: Choosing a prior distribution**
  - Non-informative priors (flat priors, Jeffreys' prior)
  - Informative priors and how to build an informative prior using external information
  - Improper priors
  - The choice of prior affects the posterior.

Examinable topics

- **Topic 6: Simulation methods**
  - How to use Monte Carlo integration to estimate posterior quantities.
  - MCMC

Examinable topics

- **Topic 7: Posterior predictive distributions**
  - Posterior predictive distributions
  - Predictive mean and predictive variance
  - **non-examinable**: simulating from the posterior predictive distribution
- **Topic 8: Bayes factors**