

HW5, Bayesian Modelling B 2016/17

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In the homeworks, questions with marks are officially ‘exam-style’, although you can expect any homework question to appear as an exam question, unless it is explicitly ‘not examinable’.

Hand in Q1–Q4.

1. Let X_i be the number of eruptions of volcano i during time interval $(t_i, \text{today}]$, measured in years, for $i = 1, \dots, m$. Let each volcano have its own eruption rate λ_i (units of /yr) and model the eruption rates as exchangeable. Write down the DAG for this model, using Θ for the hyperparameters (hint: use a plate). Write the extensive form of the model, making sensible choices for Θ , and the marginal and conditional distributions. [10 marks]
2. Write down the contents of the `Volcanoes.bug` file, and the command in `rjags` used to initialise the model in R, based on observations in the vectors `xobs` and `times`, and the value `today = 2016`. Specify four chains. [10 marks]
3. Explain how Gibbs sampling is used in this model, to estimate expectations conditional on $X = x^{\text{obs}}$. [10 marks]
4. For each unobserved random quantity in your model, write down the kernel of the full conditional distribution, conditional on $X = x^{\text{obs}}$, and identify those full conditionals which have recognisable distributions. [10 marks]
(In an exam, you would be given an explicit extensive form for the model, but in this case there is only one sensible choice.)
5. (Not examinable) Investigate how JAGS deals with full conditionals which do not have recognisable distributions.