

# List of possible questions for MLMI17 (aka 4F13) Probabilistic Machine Learning short orals

The oral exam takes place on Friday Dec 6th 2024, 8:00-17:00, for MLMI students only. The short oral will last about 12 minutes. Pen and paper will be available. The starting point for the discussion will be one question, drawn at random, from the following list:

1. Explain the relationship between linear in the parameters models and Gaussian processes
2. Explain the relationship between priors over parameters and priors over functions in Bayesian inference
3. Explain the process and results of marginalising and conditioning Gaussian processes
4. Discuss the use and role of hyperparameters in Gaussian process covariance functions and give examples
5. Explain the concept of marginal likelihood and its use in Gaussian processes
6. Explain the properties of and inference in infinitely large linear in the parameters models
7. Explain the Gibbs sampling algorithm and its practical use for inference
8. Explain the semantics and use of factor graphs
9. Explain message passing on factor graphs and the sum-product rules
10. For factor graphs, explain moment matching approximations and how to approximate inference on graphs with cycles
11. Explain the beta-binomial conjugate pair and the Dirichlet distribution
12. Explain the Expectation Maximisation (EM) algorithm in a model with observations  $y$ , latent variables  $z$  and parameters  $\theta$ .
13. Explain the Bayesian mixture of multinomials model, its graphical representation and inference algorithms
14. Explain the Latent Dirichlet Allocation model, its graphical representation and inference algorithms
15. Explain the difference between Gibbs sampling and collapsed Gibbs sampling in a mixture of multinomials model

Carl Edward Rasmussen