Exam 1 Study Guide

Math 315, Fall 2019

Logistics

- In-class exam: Wednesday, October 16
- I will provide a sheet with PDFs/PMFs for any distribution that you need on the exam.
- The exam covers material from chapters 1-3.1 of *Bayesian Statistical Methods*

Topics

Disclaimer: This list may not be exhaustive, but I hope that you find it useful in preparing for the exam.

1. Bayes' rule. Be able to apply Bayes' rule and the Bayesian thought process to conditional probability problems.
2. "The posterior is proportional to prior times likelihood." Given a prior and a likelihood, write down the posterior up to the normalizing constant.
3. Given a posterior distribution, calculate the posterior mean, median, MAP estimate, variance, standard deviation, equal-tailed credible interval (i.e. percentile interval), and $P(\theta > k)$.
4. Define informative prior, weak/diffuse/flat prior, (natural) conjugate prior, improper prior, Jeffreys' prior
5. Define elicitation and describe what it means to do elicitation well.
6. Given two quantiles, or the mean and standard deviation, describe how to determine the hyperparameters of your prior distribution in the one-parameter setting.
7. Given a sampling distribution (likliehood), derive the Jeffreys' prior.
8. Given a sampling distribution (likliehood), show that a prior is conjugate.
9. Given a sampling distributionv (likliehood), derive the natural conjugate prior.
10. Given a sampling distribution and a posterior distribution, write down the integral expression for the posterior predictive distribution. Describe how you would generate samples from the predictive distribution.
11. Given a sampling distribution and a prior distribution, write down the integral expression for the prior predictive distribution. Describe how you would generate samples from the predictive distribution.
12. Describe the algorithm for grid approximation. Describe how you would generate samples from the resulting posterior distributions.
13. Desribe how to use the Bayesian CLT to approximate the posterior distribution, and how you would generate samples from the approximate posterior.
14. Describe how to get a sample from the posterior distribution of a function of a parameter, given that you have a sample from its posterior distribution.
15. Given a two-dimensional posterior distribution, write the integral expression for the marginal distribution of one of the parameters.
16. Given a two-dimensional posterior distribution, write an expression for the conditional distribution of one of the parameters, given the other.
17. Describe how to get a sample from the marginal posterior for a parameter, given that you have a sample from the joint posterior distribution.
18. Describe how to get a sample from the posterior distribution of a function of parameters, given that you have a sample from their joint posterior distribution.
19. Describe how to "calculate" the posterior mean, median, variance, standard deviation, credible interval (i.e. percentile interval), highest posterior density interval, and $P(\theta > k)$ given a sample from the posterior distribution.