

SDS 383D: Homework 1

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Problem 1. Bayesian inference in simple conjugate families

We start with a few of the simplest building blocks for complex multivariate statistical models: the beta/binomial, normal, and inverse-gamma conjugate families.

- (A) Suppose that we take independent observations X_1, \dots, X_N from a Bernoulli sampling model with unknown probability w . That is, the X_i are the results of flipping a coin with unknown bias. Suppose that w is given a $\text{Beta}(a, b)$ prior distribution:

$$p(w) = \Gamma(a + b)w^{a-1}(1 - w)^{b-1},$$

where $\Gamma(\cdot)$ denotes the Gamma function. Derive the posterior distribution $p(w|x_1, \dots, x_N)$.

Appendix A

R code