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1 Mixture models

1. Write a two-component mixture model for data generated from two distributions: 1) a point mass at zero, and 2) a normal distribution with unknown mean and unknown variance.
2. Specify the conjugate prior for unknown mean with known variance for a normal distribution.
3. Specify the conjugate prior for unknown variance with known mean.

2 Bayesian nonparametric methods

4. Bayesian nonparametric methods place stochastic process priors on latent parameters. One dimensional temporal Gaussian processes such as Brownian motion $\{X_t, t \in [0, \infty)\}$ have $T = [0, \infty]$ as index set. What is the index set of a Dirichlet Process?
5. Consider a $DP(\alpha, Q_0)$ with $Q_0 = N(0, 1)$. Generate 10 realizations from $DP(\alpha, N(0, 1))$ with three different values of α .
6. Extend your DP model above by adding a gamma prior for α and simulate from your mixture of DPs.