

SPRING 2018
Math 7/8680: Project 1

Instructions

- Your R-code should be fully documented
- Show the trace plots using 10,000 iterations for burn-in.
- Use 1000 samples, each sample lagged by 10 samples.

Problem

Dose Response Data from an Insecticide Study

Insects were various dose levels of an insecticide

Dose	N	A
1.69	60	6
1.72	62	13
1.76	63	20
1.78	60	30
1.81	64	53
1.84	60	55
1.86	62	61
1.88	64	62

where N = number exposed, A = number adversely affected.

Let $P(d) = P(\text{Exposed insect to dose } d \text{ is adversely affected})$. and let

$$P(d) = \Phi(\beta_0 + \beta_1 d + \beta_2 d^2, 1),$$

and introducing appropriate latent variables,

1. Find Bayesian estimates of $\beta_0, \beta_1, \beta_2$, as well as the corresponding mean and variance of the posterior distributions of the latent variables estimate .
2. Repeat the above with $P(d) = \Phi(\beta_0 + \beta_1 d + \beta_2 d^2, \sigma^2)$, with prior $\tau(1/\sigma^2) \sim \text{Gamma}(1/2, 0.005)$
3. Repeat the above questions with your own choice of the values of the parameters of the Gamma prior and compare.
4. Plot a scatter graph of dose levels versus proportions of responses $\frac{A}{N}$ and superpose the two graphs of $P(d)$.