Math 314 May 2008 — Homework 3a

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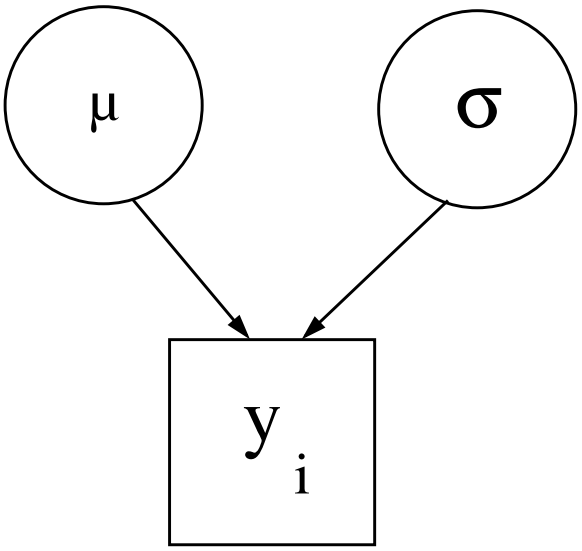
As a stepping stone to the full data set in Homework 3, here is a simpler example. The measurements are 200 measurements of the same quantity (no time here) and that quantity only depends on two parameters.



By choosing prior distributions $\mu \sim P_\mu$ and $\sigma \sim P_\sigma$ and a likelihood distribution $y_i \sim P(\mu, \sigma)$, build a Bayesian inference model:

$$P(\mu, \sigma | \{y_i\}_{i=1}^{200}) = P(\{y_i\}_{i=1}^{200} | \mu, \sigma) P_\mu P_\sigma. \tag{1}$$

Using this probability density in a Metropolis-Hastings Markov chain with candidate distribution

$$P_{\text{cand}}(\mu_{n+1}, \sigma_{n+1} | \mu_n, \sigma_n) = N((\mu_n, \sigma_n), \Sigma)$$

where $N(\boldsymbol{y}, \Sigma)$ is a multivariate normal distribution with mean $\boldsymbol{y}$ and covariance matrix Σ, sample from the posterior distribution. Use those samples to estimate the values of μ and σ used to generate the data.