

## Lab 2: Bayesian Statistics in R - STA 360/602

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### 1 Agenda

In class, you saw the Binomial-Beta model. We will now use this to solve a very real problem! Suppose I wish to determine whether the probability that a worker will fake an illness is truly 1%. Your task is to assist me! Tasks 1–2 will be completed in lab and tasks 3–5 should be completed in your weekly homework assignment.

1. Recall the Bernoulli-Beta from class and take a few minutes to work out the posterior distribution.
2. Simulate some data with  $n = 100$  observations, each having  $size = 1$  Bernoulli trial and success probability equal to .01. It's possible to sample from the Bernoulli distribution by using the `rbinom` function with  $size = 1$ . Remember to `set.seed(123)` so that you can replicate your results.
3. Write a function that takes as its inputs that data you simulated (or any data of the same type) and a sequence of  $\theta$  values of length 1000 and produces Likelihood values based on the Bernoulli Likelihood. Plot your sequence and its corresponding Likelihood function.
4. Write a function that takes as its inputs prior parameters `a` and `b` for the Beta-Bernoulli model and the observed data, and produces the posterior parameters you need for the model. Generate the posterior parameters for a non-informative prior i.e.  $(a,b) = (1,1)$  and for an informative case  $(a,b) = (3,1)$
5. Create two plots, one for the informative and one for the non-informative case to show the posterior distribution and superimpose the prior distributions on each along with the likelihood. What do you see? Remember to turn the y-axis ticks off since superimposing may make the scale non-sense.