STA6241 - STDA
Homework 2
DUE Friday, May 1st

Feel free to work together, but your answers/code should be your own. You must write up your solutions using `LaTeX`. You should submit one pdf file containing solutions/codes.

1. In this problem we will carry out profile log-likelihood methods based on the provided code (HW2.R). You may use the same simulation settings as in the provided code.

   - Visualize profile log-likelihood function of ρ for $[0.005, 0.5]$ interval.
   - Obtain MLE for ρ, β, σ^2. (Hint: you may use `optimize` or `optim` function in R to get MLE of ρ.)

2. STDA4 slide (page 7): Based on the provided code (STDA4.R),

   - Clearly write down conditional distribution for $\beta, \tau, \sigma^2, \eta_{obs}$. You no need to write down for ρ because there is no closed form.
   - clearly write down pseudo-code of the Metropolis-Gibbs sampler.
   - Replicate the results: (1) Provide MCMC diagnostic plots for β, τ, σ^2. (2) Provide prediction maps (both predictive posterior mean and standard deviation).

3. STDA4 slide (page 24): Implement Nimble-based MCMC code for Binomial data. Report results for MCMC samples for β, ρ, σ^2 (posterior mean, trace plots, highest posterior density (hpd)).