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Bayesian Learning, 6 hp

Computer lab 3

You can use any programming language for the labs, but my hints, help and solutions will be in R.
You are allowed to work and submit your labs in pairs, but do make sure that both of you are contributing.
The **deadline** for this lab is **December** 5.

1. *Gibbs sampling for a normal model with semi-conjugate prior.*
   Let $x_1, ..., x_n|\theta, \sigma^2 \sim N(\theta, \sigma^2)$ where both θ and σ^2 are unknown. Let $\theta \sim N(\mu_0, \tau_0^2)$ independently of $\sigma^2 \sim Inv - \chi^2(\nu_0, \sigma_0^2)$.

   (a) Implement (code!) a Gibbs sampler that simulates from the joint posterior $p(\theta, \sigma^2|x_1, ..., x_n)$. [Hint: the conditional posteriors are given on the slides from Lecture 8].

   (b) Analyze the log(wage) in the dataset CanadianWages.dat using your Gibbs sampler in a). Investigate the convergence of the Gibbs sampler by suitable graphical methods. Is the Gibbs sampler efficient?

2. *Binary regression models*

   (a) Use my code OptimizeSpamR.zip from the course web page to analyze the spam data set using logistic regression. Approximate the posterior of the regression coefficients β by $N(\tilde{\beta}, J^{-1})$, where J is the observed information matrix evaluated at the posterior mode $\tilde{\beta}$. All of this is given by the code. Use the prior $\beta \sim N(0, \tau^2 I)$, with $\tau = 10$.

   (b) Implement (code!) a data augmentation Gibbs sampler for the probit regression model. [Hint: `rtnorm` funktionen i `msm`-paketet.]

   (c) Analyze the spam data using your code from b), again using the prior $\beta \sim N(0, \tau^2 I)$, with $\tau = 10$.

   (d) Compare the results in a) and c).

May Bayes be with you!