Elementary Bayesian Analysis **Exam 18.12.2007**

Use equations to clarify your answers if necessary.

1. Describe briefly (total of about one page) the following terms and what is their significance in Bayesian analysis:
   a) Semi-conjugate prior (1p)
   b) Predictive distribution (1p)
   c) HPD-interval (1p)
   d) Monte carlo error (1p)
   e) Grid sampling (1p)
   f) Sensitivity analysis (1p)
2. Explain terms informative and non-informative prior, and explain their purpose, pros and cons. (6p)
3. Exchangeability
   a) Explain briefly the term exchangeability and give an example. (2p)
   b) Does exchangeability imply independence? Explain. (2p)
   c) How is exchangeability related to hierarchical models? Give an example. (2p)
4. Compare pros and cons of Gibbs sampling and Metropolis-Hasting algorithm and describe how the choice of MCMC-algorithm may be affected by the model. (6p)
5. Describe posterior predictive checking and its pros and cons. (6p)

Elementary Bayesian Analysis **Exam 22.1.2009**

Use equations to clarify your answers if necessary.

1. Describe briefly (total of about one page) the following terms and what is their significance in Bayesian modeling:

   a) Non-informative prior distribution (1p)

   b) Posterior distribution (1p)

   c) Marginal distribution (1p)

   d) Observed information (1p)

   e) Grid sampling (1p)

   f) Utility function (1p)

2. Describe posterior predictive checking and mention at least one good and one bad property. (3p).

3. Explain why exchangeability is important concept in bayesian modeling. (3p)

4. Markov chain Monte Carlo (MCMC)

   a) Describe briefly Metropolis algorithm and mention also its good and bad properties. (3p)

   b) What is the transition distribution produced by Metropolis algorithm? (1p)

   c) Describe the relation between Gibbs and Metropolis algorithms. (2p)

5. Explain Monte Carlo error, how it can be estimated in different situtations, and give an simple example. (6 p)

6. Decision analysis

   A patient may have a severe disease. Without an operation the probability of recovery is 5%. If the patient with the disease is operated, the probability of recovery is 50%. Operation is dangerous and thus even if the patient does not have the disease there is 20% chance that the patient dies as a result of the operation.

   If the operation is done and the patient lives is recovery complete. If the operation is not done and the patient has the disease, recovery is only partial. If the patient does not have the disease and the patient does not die is recovery complete.

   Advise the doctor in making the decision to operate. You may use following costs: complete recovery = 0, partial recovery = λ, and death = 1.

Elementary Bayesian Analysis **Exam 1.6.2009**

11.6.2009

Use equations to clarify your answers if necessary. (You may answer in Finnish, too)

1. Describe briefly (total of about one page) the following terms and what is their significance in Bayesian analysis:
   a) Burn-in
   b) Predictive distribution (1p)
   c) HPD-interval (1p)
   d) Aliasing (1p)
   e) Stable treatment (1p)
   f) Sensitivity analysis (1p)
2. Explain terms informative and non-informative prior, and explain their purpose, pros and cons. (6p)
3. Exchangeability
   a) Explain briefly the term exchangeability and give an example. (2p)
   b) Does exchangeability imply independence? Explain. (2p)
   c) How is exchangeability related to hierarchical models? Give an example. (2p)
4. Compare pros and cons of Gibbs sampling and Metropolis-Hasting algorithm and describe how the choice of MCMC-algorithm may be affected by the model. (6p)
5. Describe posterior predictive checking and its pros and cons. (6p)