INSTITUT TEKNOLOGI SEPULUH NOPEMBER
FACULTY OF SCIENCE AND DATA ANALYTICS
DEPARTMENT OF STATISTICS
STATISTICS UNDERGRADUATE PROGRAM

Course	Course Name	:	**Computational Bayesian Analysis**
	Course Code	:	SS234741
	Credit	:	3 SKS
	Semester	:	VI

COURSE DESCRIPTION

This course discusses the concept and application of the Bayesian method to perform data driven statistical inference which includes estimating distribution parameters and estimating statistical models, as well as selecting the best model for a data. The learning process starts from discussing the concept of Bayes' theorem, introducing, and determining the prior distribution, and arranging the posterior distribution. The estimation of the posterior model is done both mathematically and computationally by applying Bayesian MCMC in Win BUGS. The implementation of Bayesian analysis will be carried out for both single and multiple parameterized models and for simple linear regression. It also discusses the comparisons (advantages and disadvantages) of the Bayesian and frequentist methods. At the end of the lecture, it will be discussed how to choose the best model in Bayesian modeling.

PROGRAM LEARNING OUTCOME

PLO-4	Able to apply science and mathematics to support the understanding of statistical methods
PLO-5	Able to apply statistical theory to statistical methods
PLO-7	Able to use modern computing devices to solve statistical problems
PLO-9	Able to apply statistical methods to analyze theoretical and real problems
PLO-10	Able to apply business, industrial, economic, social, health or environmental statistical methods to real problems

COURSE LEARNING OUTCOME

CLO. 1	Able to identify data distribution with the goodness of fit test and be able to estimate data distribution parameters frequently in
CLO. 2	Able to distinguish and pattern Value of parameter estimation if given data from observations in different situations and conditions.
CLO. 3	Be able to explain and differentiate ways of determining the types of priors and hyper-prior structures required in the parameter estimation process.
CLO. 4	Able to determine the prior distribution of discrete distribution parameters and continuous which has one parameter (Discrete: Bernoulli, Poisson; Continuous: Experimental, Normal sigma known)
CLO. 5	Be able to determine the posterior distribution of discrete and continuous distribution parameters which have one para meter of
CLO. 6	Be able to explain the basic principles of Bayesian computation in constructing the posterior distribution of parameters from a numerically parameter data pattern
CLO. 7	Able to compile a posterior data generator algorithm with a single parameter

	distribution parameter
CLO. 8	Able to explain the Markov Cain Monte Carlo concept in the parameter estimation.
CLO. 9	Able to create and explain doodle structure and posterior estimation program syntax in Win BUGS for a distribution mode l with a single parameter

MAIN SUBJECT

1. Bayesian theorem and Bayesian inference
2. MLE, Kolmogorov-Smirnov
3. Model parameters asvariables
4. Prior and Hyper-Prior
5. Prior Jeffrey's
6. Proportional Posterior
7. Integral concept and computational parameter estimation
8. Data augmentation dan Markov Chain Monte Carlo (MCMC)
9. Node (Stochastic, logical, constant), path, and Frame as an integrality form of Bayesian estimation
10. Bayes Computing Convergence and hypothesis testing in Win BUGS
11. Able to distinguish the effects of prior differences in modeling problems with Bayesian multiple parameters
12. MCMC and Bayesian convergence of multiple parameters
13. Hyper-parameter and hierarchical model
14. Bayes odds, Multiplication Distribution Structure, Deviance

PREREQUISITE

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3. Ghosh, J.K., Delampady, M., and Samanta, T., 2006. An Introduction to Bayesian Analisis: Theory and Methods. New York, USA : Springer.
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5. Ntzoufras, I., 2009. Bayesian Modeling Using WinBUGS. New Jersey, USA : John Wiley dan Sons.
6. Robert, C. P., 2007. The Bayesian Choice: From Decision- Theoretic Foundations to Computational Implementation. 2nd edition. New York, USA : Springer.
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9. Reynolds, C. dan Tymann,P., 2003. Principles of Computer Science. McGraw-Hill.
10. Tremblay dan Bunt. 2000. An Introduction to Computer Science and Algorithm Approach. McGraw-Hill.
11. Verschuuren, G, M. 2008. Excel 2007 for Scientists. Holy Macro Books.