# BAYESIAN STATISTICS

# STAT 8700

**Course Description:**

The objective of this course is to introduce the Bayesian approach to statistical inference. Topics covered include: Review of probability, Bayes theorem, and Likelihood; The Bayesian methodology, prior and posterior distributions; Choices of prior distribution, conjugate and Jeffreys priors; Credible intervals and inference; Bayesian computation - Markov Chain Monte Carlo and the Gibbs Sampler; Hierarchical models; Regression models. Statistical Software will be used. **3 credits**

**Prerequisites:**

MATH 8756 or equivalent or permission of instructor.

**Overview of content and purpose of the course:**

In introductory statistics courses, statistical inference is usually taught using the 'classical' or 'frequentist' approach. In this approach, the parameters of the model are treated as unknown constants to be estimated, and all inference is based on the concept of considering all possible random samples.

In the Bayesian approach, the parameters are considered random variables, and inference is based on the 'posterior' distribution of the paramter which is a combination of ones prior knowledge of the paramter, and the information gathered from the data.

Several advantages of the Bayesian approach is the framework is all based on the language of probability, and that some of the estimation methods have simpler interpretations than their classical equivalents.

Bayesian statistics has really exploded in recent times, due to the availability of computing power which is often required to perform some of the more complicated calculations.

**Anticipated audience/demand:**

Graduate students in mathematics, engineering, business, and computer science who are interested in data analysis.

**Major topics:**

**1)** Introduction to the Bayesian Methodology

**2)** Prior and Posterior Distributions

**3)** Choice of Prior Distribution - Conjugate, Jeffreys, and Noninformative Priors

**4)** Linear Models using Bayesian Methodology

**5)** Bayesian Hypothesis Testing

**6)** Bayesian Compuation - MCMC, Gibbs Sampler

**7)** Hierarchical Models

**Methods:**

The class will be presented primarily in lecture form with student discussion encouraged. Questions are encouraged in class and out.

**Student role:**

Students must attend and participate in class in addition to completing course requirements. Students are expected to do reading and assignments as they are assigned.

**Textbook:**

Bolstad W. M. (2007). Introduction to Bayesian Statistics. 2nd ed. Hoboken, NJ: Wiley.

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