



# Statistics 442

## Spring 2020

### **Course Description: Introduction to Bayesian Data Analysis**

The course will introduce data analysis from the Bayesian perspective to undergraduate students. We will cover important concepts in Bayesian probability modeling as well as estimation using both optimization and simulation-based strategies. Key topics covered in the course include hierarchical models, mixture models, hidden Markov models and Markov Chain Monte Carlo.

### **Prerequisites:**

1. A course in probability (Statistics 430 or equivalent)
2. A course in statistical inference (Stat 102, Stat 112, Stat 431 or equivalent)
3. Basic knowledge of linear algebra (e.g. matrix multiplication and inversion, etc.)
3. Experience with the statistical software R (at the level of Stat 405 or Stat 470)

### **Professor:**

Dr. Shane Jensen  
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**Lectures:** Section 1: TTh 1:30-3pm SHDH 107  
Section 2: TTh 3-4:30pm SHDH 107

**Office Hours:** Wed 2:30-4:30pm JMHH 463

### **Required Textbook:**

Bayesian Data Analysis (3<sup>rd</sup> Edition) by Gelman, et.al.

### **Required Software:**

The R statistical package is needed and can be downloaded at [www.r-project.org](http://www.r-project.org)

**Midterm 1 Exam:** Tuesday, March 3 (in class)

**Midterm 2 Exam:** Tuesday, April 28 (in class)

## **Course Topics**

1. Introduction to Bayesian Inference (Ch.1)
2. Simple Parametric Models (Ch. 2, 3)
3. Regression Models from the Bayesian Perspective (Ch. 14,15)
4. Hierarchical and Mixture Models (Ch. 5)
5. Optimization Algorithms for Model Estimation (Ch. 13)
6. Monte Carlo Simulation Algorithms for Model Estimation (Ch. 10,12,13)
7. Model Checking (Ch. 6,7)
8. Nonparametric and Semiparametric Bayesian models (Ch. 23)
9. Hidden Markov Models

## **Evaluation:**

Your course grade will be calculated as:

- 40% homeworks
- 30% for the midterm 1 examination
- 30% for the midterm 2 examination

## **Notes about Grading:**

- *No late homeworks will be accepted, for any reason whatsoever.*
- **No make-up midterms will be given, so make sure that you do not have other commitments during the midterm times**