MATH 605 Bayesian Analysis (Spring 2017)

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**Textbook**: Robert, C., *The Bayesian Choice (2nd Edition)*, Springer, 2001, [Amazon link](../Dropbox/BU%20teaching/arxiv/605%20Bayesian%20Analysis/BA%20textbook.htm).

Bayesian statistics is what everybody is talking about these days. Here, the “everybody” includes statisticians, machine learners, data analyst, physicians, scientist, even high school kids. Upon closer inspection, the popularity of Bayesian analysis does not come as a surprise. In contrast to classical statistics, Bayesian inference is more principled, coherent, unbiased, and can directly address one of the most important questions in science: **in which of my hypothesis should I believe in, and how strongly, given the collected data?**

**The aim of this graduate-level course is to introduce the foundation of Bayesian analysis and how it applies to modern data sciences including computer science and machine learning. The students are expected to learn the most basic Bayesian methods and related problem solving skills. Below is a tentative list of topics to be covered:**

* Priors (conjugate, noninformative, reference)
* Hierarchical models, spatial models, longitudinal models, dynamic models, survival models
* Testing
* Model choice
* Inference (importance sampling, MCMC, sequential Monte Carlo)
* Nonparametric models (Dirichlet processes, Gaussian processes, neutral-to-the-right processes, completely random measures)
* Decision theory and frequentist perspectives (complete class theorems, consistency, empirical Bayes)

**Grading policy**:

1. Homework (60%).
2. Final Exam (40%).