**Complete List of Topics and Reading Materials**

(STT 465, Fall 2017)

**Required readings:**

* Chapters 1-6, 9, 10 of book by Peter D. Hoff
* Notes on the multiple linear regression model (available in GitHub)
* All the examples and code posted in the GitHub repository.

**Topics you should be very familiar with**

- **Basic probability concepts**:

- Expectation, Variance and covariance, definition and properties

- Joint, conditional and marginal distributions.

- **Probability concepts for Bayesian models**:

* + Conditional distribution of the data given the parameters (aka Likelihood)
  + Prior distribution
  + Bayes Theorem
  + Joint posterior
  + Predictive distribution
  + Marginal posterior
  + Fully conditional distributions
* Basic (Frequentist) concepts of **likelihood inference** (for all the single parameter models and also for the normal model with unknown mean and unknown variance):
  + Maximum likelihood (Derivation in simple models)
  + Bias and variance of MLE estimates (only for those with closed forms)
  + Constructing and interpreting 95% CI
* **Models** (for all the following models you are expected to know how to set the likelihood, be familiar with conjugate priors, derive the posterior distribution for single parameter models, derive fully-conditionals, and outline a Gibbs sampler for multi-parameter models)
  + Beta-Binomial
  + Poisson-Gamma
  + Normal model with unknown mean ad unknown variance
  + Simple and multiple linear regression model
* Monte-Carlo Methods
  + When and why we use them?
  + Gibbs sampler
  + Metropolis, Metropolis-Hastings, Rejection Sampling
  + Monte-Carlo error (what is it, how we reduce it, what factors affect it).
  + Analyses of Monte-Carlo samples: trace plot, burn-in, posterior auto-correlation, effective number of samples, Monte-Carlo error, estimated posterior mean, posterior standard deviations and credibility regions.