**HW3 STT 465**

**(MSU, Fall, 2015)**

Due: Wednesday, Oct 14th, 2015 in class (hard copy) or by e-mail (pdf).

**Note:** Please provide a report as neat as you can, with clear answers. Include the derivation as part of your answers and the code at the end of the answer.

**Data.**  For this HW we will use the data set LDL.txt (the data set is in the github resository). This data set contains measurements of Low-density lipoprotein (LDL cholesterol) in female and male patients. The overall goal of the analysis is to determine whether there are systematic differences in the mean and variance of LDL cholesterol between male and female patients.

**1. Descriptive statistics**

1.1. Provide descriptive statistics by group and a boxplot of LDL cholesterol versus sex.

1.2. Summarize your findings.

**2. Likelihood analyses**

Assume that LDL cholesterol is distributed normal with mean and variances that are sex-specific, that is,

and

2.1. Write down the likelihood function for one of the groups.

2.2. Derive the Maximum Likelihood estimators of the mean and variance

2.3. Using the data compute and report the MLE estimate of the mean and variances of each of the groups, and an approximate 95% CI for the means of the groups.

**3. Bayesian Analyses**

For the Bayesian Analysis we will assume the following priors

3.1. For one of the groups, derive the fully conditional distributions of the mean and variance.

3.2. Describe conceptually a Gibbs Sampler for estimating the posterior distributions of the mean and variance.

Run the Gibbs sampler with 50,000 iterations collected after discarding 500 samples and burn in. From the Gibbs ampler report: Posterior Means, Posterior standard deviations, and 95% Bayesian Credibility Regions.

3.3.

3.4.

**4. Convergence diagnostics**