

# MATH 390.03-02 / 650 Spring 2016 Homework #10

Professor Adam Kapelner

Due 4PM, Friday, May 20, 2016

(but can be handed in without penalty until May 25, 2016 at 8:30AM)

(this document last updated Monday 9<sup>th</sup> May, 2016 at 5:27pm)

## Instructions and Philosophy

The path to success in this class is to do many problems. Unlike other courses, exclusively doing reading(s) will not help. Coming to lecture is akin to watching workout videos; thinking about and solving problems on your own is the actual “working out.” Feel free to “work out” with others; **I want you to work on this in groups.**

Reading is still *required*. For this homework set, read about ridge regression and Gibbs sampling. Also read ch17 and the epilogue in McGrayne.

The problems below are color coded: **green** problems are considered *easy* and marked “[easy]”; **yellow** problems are considered *intermediate* and marked “[harder]”, **red** problems are considered *difficult* and marked “[difficult]” and **purple** problems are extra credit. The *easy* problems are intended to be “giveaways” if you went to class. Do as much as you can of the others; I expect you to at least attempt the *difficult* problems.

Problems marked “[MA]” are for the masters students only (those enrolled in the 650 course). For those in 390, doing these questions will count as extra credit.

This homework is worth 100 points but the point distribution will not be determined until after the due date. See syllabus for the policy on late homework.

Up to 10 points are given as a bonus if the homework is typed using L<sup>A</sup>T<sub>E</sub>X. Links to installing L<sup>A</sup>T<sub>E</sub>X and program for compiling L<sup>A</sup>T<sub>E</sub>X is found on the syllabus. You are encouraged to use [overleaf.com](http://overleaf.com). If you are handing in homework this way, read the comments in the code; there are two lines to comment out and you should replace my name with yours and write your section. The easiest way to use overleaf is to copy the raw text from hwxx.tex and preamble.tex into two new overleaf tex files with the same name. If you are asked to make drawings, you can take a picture of your handwritten drawing and insert them as figures or leave space using the “\vspace” command and draw them in after printing or attach them stapled.

The document is available with spaces for you to write your answers. If not using L<sup>A</sup>T<sub>E</sub>X, print this document and write in your answers. I do not accept homeworks which are *not* on this printout. Keep this first page printed for your records.

NAME: \_\_\_\_\_

## Problem 1

These are questions about McGrayne's book, chapter 17 and the Epilogue.

- (a) [easy] What do the computer scientists who adopted Bayesian methods care most about and whose view do they subscribe to? (p233)
  
  
  
  
  
  
  
  
  
  
- (b) [easy] How was "Stanley" able to cross the Nevada desert?
  
  
  
  
  
  
  
  
  
  
- (c) [easy] What two factors are leading to the "crumbling of the Tower of Babel?"
  
  
  
  
  
  
  
  
  
  
- (d) [harder] Does the brain work through iterative Bayesian modeling?
  
  
  
  
  
  
  
  
  
  
- (e) [easy] According to Geman, what is the most powerful argument for Bayesian Statistics?

## Problem 2

These are questions introduce Gibbs Sampling.

- (b) [harder] We previously have shown that if  $X \mid \theta \sim \text{Binomial}(n, \theta)$  and the prior on  $\theta \sim \text{Beta}(\alpha, \beta)$ , then  $X \sim \text{BetaBinomial}(n, \alpha, \beta)$ . Even though we proved this result, pretend like you didn't know it and create a Gibbs sampler which finds  $\mathbb{P}(X)$ .