MATH 390.03-02 / 650 Fall 2015 Homework #4

Professor Adam Kapelner

Due 4PM in my mail slot, Friday, March 4, 2015

(this document last updated Sunday 21st February, 2016 at 5:07pm)

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 Bayesian Hypothesis testing, Bayes Factors and again the beta prior, the binomial-beta bayesian formulation, the beta-binomial model. Also read ch7- 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 LaTeX. Links to instaling LaTeX and program for compiling LaTeX is found on the syllabus. You are encouraged to use `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 LaTeX, 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, chapters 8-.

(a) [easy] When was experimentation introduced to medical science and who introduced it? Are you surprised that it was this recent?

(b) [easy] Sir Ronald A. Fisher, the founder of modern experiments, did not believe cigarettes caused lung cancer. What were his two hypotheses for the cause of lung cancer?

(c) [easy] Who invented, and what are Bayes Factors? (p116)

(d) [easy] Trick question: who convinced Cornfield to stop smoking?

(e) [easy] Why were frequentists at a loss to estimate the probability of a nuclear bomb being detonated by accident?

(f) [easy] What is Cromwell's Rule? And, when applying this principle to a Bayesian model what would it imply? (See the Wikipedia link and p123).

(g) [easy] Did Bayesian Statistics prevent nuclear war? Discuss

(h) [easy] What is the main reason why there are so many variations of Bayesian interpretation? (p129)

(i) [easy] What is a large practical drawback of Bayesian inference?