

MATH 390.03-02 / 650 Fall 2015 Homework #2

Professor Adam Kapelner

Due 4PM in my mail slot, Friday, February 19, 2015

(this document last updated Wednesday 10th February, 2016 at 9:07am)

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, review Math 241 concerning random variables, support, parameter space, PMF’s, PDF’s, CDF’s, Bayes Rule, read about parametric families and maximum likelihood estimators on the Internet, read the preface and ch 1 and 4 of Bolstad and read the preface and Ch1 of 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^AT_EX. Links to installing L^AT_EX and program for compiling L^AT_EX 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 L^AT_EX, 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, preface, chapter 1, 2 and 3.

(a) [easy] Explain Hume's problem of induction with the sun rising every day.

(b) [easy] Explain the "inverse probability problem."

(c) [easy] What is Bayes' billiard table problem?

(d) [difficult] [MA] How did Price use Bayes' idea to prove the existence of the deity?

(e) [easy] Why should Bayes Rule really be called "Laplace's Rule?"

(f) [difficult] Prove the version of Bayes Rule found on page 20. State your assumption(s) explicitly. Reference class notes as well.

(g) [easy] Give two problems / domains Laplace used the inverse probability theory to help solve

(h) [difficult] [MA] Why did Laplace turn into a frequentist later in life?

(i) [easy] State Laplace's version of Bayes Rule (p31).

(j) [easy] Why was Bayes Rule damned (pp36-37)?

(k) [easy] According to Edward Molina, what is the prior (p41)?

(l) [easy] What is the source of the “credibility” metric that insurance companies used in the 1920’s?

(m) [difficult] In class we discussed the “principle of indifference” which is a term I borrowed from Donald Gillies’ Philosophical Theories of Probability. McGrayne in her research of original sources comes up with many names for this principle. List all of them here.

Problem 2

More about likelihood estimators

(a) [easy] Write the PDF of X .