HW1, Theory of Inference 2015/6

Jonathan Rougier

School of Mathematics

University of Bristol UK

A general statement on homeworks. These homeworks are an opportunity for you to develop your understanding, and to practice your maths and communication skills. If you hand-in your homeworks, you will get feedback on how well you are doing. You are *strongly encouraged* to hand-in your homeworks.

It is crucial that you express your answers clearly, in well-structured sentences. Where you are writing maths, your writing must be tidy enough that there can be no ambiguity about symbols and the names of variables. The way you lay-out your maths must be logical and clear, using indentation, alignment, and other standard conventions. This is a skill you must master before you leave the University. Future employers and colleagues will rightly be critical of sloppy thinking and sloppy communicating.

I am told by students that my marking criteria are very strict. Please be absolutely clear that I am marking according to the the criteria that you will be judged by when you leave the University. Do not be put off by low marks. Come to an Office Hour to discuss how you could have done better, and study the solutions.

In the following questions, I show marks in square brackets, to give you an idea of the approximate tariff the question would carry in an exam.

1. Study the Dutch book argument for conditional probabilities (sec. 1.8 in the handout). Then adapt the proof to show that, under coherence

   (a) If Q implies P, then $0 < p = q < r = 1$,

(b) If Q implies $\neg P$, then $0 = p = r < q < 1$.

Insert these values into eq. (1.39) in the handout to check them for sense. [10 marks]

2. In the notes, my statement of the converse case in the Dutch book argument for conditional probabilities is messy. Try to do better. There is a piece of cake for successful attempts.

3. The Mayor of Bristol would like to know about the probability of damage to the nuclear power station at Hinkley Point in the event of a Magnitude 4 ashy eruption in Iceland, into a north-westerly wind. After working with a team of volcanologists and meteorologists, you report that your team's probability is 0.0015.[1] Describe the propositions on which this value is based. Give an informal account to the Mayor of what this number represents. [10 marks]

---

[1]I made this number up!