Statistics 5444: Homework 1 Supplement

For each homework assignment, turn in at the beginning of class on the indicated due date. Late assignments will only be accepted with special permission. Write each problem up *very* neatly (LaTeX is preferred). Show all of your work.

Problem 4

See P.M. Lee, page 10. The top paragraph illustrates the *prosecutor's fallacy*. After reading, the Author states that the two (under the scenario illustrated in the paragraph) conditional distributions $p(E|I)$ and $P(I|E)$ are "equal if and on if the prior probability $P(I)$ of innocence is taken to be $\frac{1}{2}$". Justify his claim (i.e. show that the prior must equal 1/2 (approximately??)).

The passage from P.M. Lee follows as:

Suppose a crime has been committed. Blood is found at the scene for which there is no innocent explanation. It is of a type which is present in 1% of the population. The prosecutor may then state

'There is a 1% chance that the defendant would have the crime blood type if he were innocent. Thus there is a 99% chance that he is guilty.'

Alternatively, the defender may state

'This crime occurred in a city of 800,000 people. This blood type would be found in approximately 8,000 people. The evidence has provided a probability of 1 in 8,000 that the defendant is guilty and thus has no relevance.'

The first of these is known as the *prosecutor's fallacy* or the *fallacy of the transposed conditional*, and as pointed out above, in essence it consists in quoting the probability $P(E|I)$ (E= evidence, I=innocence) instead of $P(I|E)$. The two are equal if and only if the prior probability $P(I)$ of innocence is taken as $\frac{1}{2}$, which is scarcely in accord with a presumption of innocence. The second of these is known as the *defender's fallacy* which consists of reporting $P(G|E)$ (G=guilt), without regard to $P(G)$.