

## Homework 8

Critical Thinking GEA 101

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Your Name: \_\_\_\_\_

Student ID#: \_\_\_\_\_

Here is your chance to redeem yourself. There were two issues that I noticed students were confused about: the base rate neglect fallacy and alternate explanations for observed correlations. I went over these more in class, in the hopes that you would understand. This stuff will be on the exam, so that's why I'm so concerned: I want you to do well!

### Question #1

The base rate neglect fallacy is often called the prosecutor's fallacy for good reason. Here's a good review of how the fallacy works (note: this is really good reading, and better than the powerpoint slides in class):

[http://www.conceptstew.co.uk/PAGES/prosecutors\\_fallacy.html](http://www.conceptstew.co.uk/PAGES/prosecutors_fallacy.html)

Suppose you go to a casino, to play roulette.

Here is a highly simplified version of the rules of roulette:

You place a bet on either black or red. You have a 50% chance of winning if you picked black, and a 50% chance of winning if you picked red.

[For our purposes here, roulette is similar to betting on the outcomes of coin flips: if you pick heads, you win 50% of the time and if you pick tails you win 50% of the time.]

Suppose that you place bets 10 times and win every time, acquiring a sum of chips in the millions of dollars. The casino refuses to pay you money, arguing that you cheated.

(This actually happens: <http://www.dailymail.co.uk/news/article-2213888/Punto-Banco-Worlds-number-poker-player-wins-7-3m-2-nights-London-casino-REFUSES-pay-out.html> )

Here's the casino's argument: the probability of winning ten times at roulette by chance (as I've described the rules) is  $\frac{1}{2}$  times itself 10 times, or  $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = 1$  in 1,024. The probability that someone who cheated would win is 100%. So you're a cheater, and don't deserve your winnings.

The casino has committed the base rate neglect fallacy.

What is the true probability that you cheated, given that you won 10 times in a row at roulette? You will need to know this:

- 1,024,000 people (including you) have played roulette 10 times in a row at the casino (and nobody ever plays more or less times in a row).
- The probability that a randomly selected roulette player cheated is 250 in 1,024,000.

The probability that you are a cheater given that you won 10 times in a row is:

WRITE ANSWER HERE: \_\_\_\_\_

[It might help me give you partial credit if you explained your reasoning. There's some empty space below for you to do that.]

## Question #2

In Chicago, there's a correlation between street crime and car crashes:

<http://www.chicagomag.com/Chicago-Magazine/The-312/October-2012/The-Link-Between-Car-Crashes-and-Street-Crime/>

The correlation is that when an area of Chicago has more street crime, it has more car crashes, and when it has less street crime, it has fewer car crashes.

I want you to give me three explanations:

1. Explain how car crashes might cause street crime.
2. Explain how street crime might cause car crashes.
3. Explain how some other factor might cause both car crashes and street crime.

Write your explanations on any paper you want, but make sure to label them 1, 2, and 3.