

## ***Problem Set 1***

Research Design for Causal Inference

Due: April 7, 2015

### Part I – Key topics

While doing the reading and problem set this week, focus on understanding the following key topics, which we will likely discuss in class:

- Potential outcomes (including notation).
- Average treatment effects.
- Expected value (including notation).
- Random assignment.
- Unbiased estimator.
- Excludability.
- Non-interference.

### Part II – Gerber & Green

Complete the following exercises from FEDAI:

**Chapter 1:** Exercise 1(b).

**Chapter 2:** Exercise 1, 2, 5, and 7. For question 2, please complete your calculations using the statistical software of your choice.

### Part III – “No causation without manipulation”?

It is often said that within the potential outcomes framework effects can only be understood empirically in relation to causal variables that have been manipulated in some way.

- (a) Explain why this notion of *manipulation* matters so much.
- (b) What are the implications of this for research into relatively stable attributes of people such as phenotype (skin color) or gender?