NAME (Please Print): _____

Statistics 320 (2014Spring) **Quiz 4**

Assume we obtain data from a randomized experiment with **two-sided noncompliance**. Denote the assignment by Z (binary), the treatment received by W (binary), and the outcome by Y. The number of units classified by their Z and W values is shown in the following 2×2 table.

Table 1: Number of units classified by their observed Z and W values

	$W=0$	$W=1$
$Z=0$	n_{00}	n_{01}
$Z=1$	n_{10}	n_{11}

1. (1 point) Explain the difference between effectiveness and efficacy.

   Effectiveness: the effect of a treatment work in practice. Efficacy: the effect of a treatment in ideal situations. Effectiveness is more of policy interest (population level), whereas efficacy is more of clinical or scientific interest (individual level).

2. (1 point) Define the intention-to-treat (ITT) effect of the assignment, using the potential outcome notations.

   ITT=$E(Y(1)-Y(0))$.

3. (2 points) Name and describe the four possible compliance types.

   1. Never-takers (0,0): units who would not receive the treatment regardless of the assignment.
   2. Compliers (0,1): units who would receive the treatment that they are assigned to.
   3. Always-takers (1,1): units who would receive the treatment regardless of the assignment.
   4. Defiers (1,0): units who receive the opposite treatment he/she is assigned.

4. (1 point) Define the compliers average causal effect (CACE), using the potential outcome notations.

   CACE=$E(Y(1)-Y(0)|W(0)=0, W(1)=1)$ or equivalently CACE=$E(Y(1)-Y(0)|S=\text{compliers})$.

5. (3 points) List the assumptions required to estimate the CACE.

   1. SUTVA; 2. Randomized assignment; 3. Monotonicity; 4. Exclusion restriction for never-takers and always-takers; 5. No-zero proportion of compliers. (You get full credit if you correctly answer any three of the five

6. (2 points) Under the assumptions listed in Question 5, write down the formulas (using the $n_{z,w}$ notations in Table 1) for estimating the proportion of compliers.

   $\widehat{\Pr}(c) = 1 - \frac{n_{01}}{n_{01}+n_{00}} - \frac{n_{10}}{n_{10}+n_{11}}$