Biost 578: Problem Set 1

Department of Biostatistics @ University of Washington

Alejandro Hernandez

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Problem 1

Table 1: Rigr estimates of ATE

Estimator	Estimate	Robust SE	Pr(>|t|)
ANOVA	-0.2103	0.0243	0
ANCOVA	-0.2210	0.0117	0
ANHECOVA	-0.2251	0.0000	0

Table 2: RobinCar estimates of ATE

Estimator	Estimate	Robust SE	Pr(>|t|)
ANOVA	-0.2103	0.0243	0
ANCOVA	-0.2210	0.0117	0
ANHECOVA	-0.2251	0.0103	0

Problem 2

Table 3: Estimators of ATE

Estimator	Estimate	Robust.SE
ANOVA	0.337	-
ANOVA (RobinCar)	0.328	-
g-computation (rigr)	0.328	-
g-computation (RobinCar)	0.328	0.041

Problem 3

Table 4: Estimators of ATE

Estimator	Estimate	Robust.SE
ANOVA	1.491	-
ANOVA (RobinCar)	1.491	-

Estimator	Estimate	Robust.SE
g-computation (rigr)	1.291	-
g-computation (RobinCar)	1.417	0.17

Problem 4 (Ungraded)

In this problem, we consider randomization inference for non-binary treatments. Consider a setting in which we have n units labelled i = 1, ..., n, but instead of the usual binary intervention, we have K possible treatments, i.e. $\mathrm{A_i} \in \{1, \ldots, K\}$. Consider the generalization of the completely randomized design seen in class, with K treatments. That is, for fixed values $0 < n_1, \ldots, n_K < n$, we assign exactly $n_1$units to treatment 1, n_2 units to treatment 2, ..., and n_K units to treatment K, such that all items have equal probability.

(a)

For $k \in \{1, \ldots, K\}$, determine $\mathrm{P}\ (\mathrm{A_i} = k)$.

(b)

Assuming SUTVA, how many potential outcomes does each unit have?

(c)

For $k \neq k' \in \{1, \ldots, K\}$ write down $\tau_{\mathrm{kk'}}$ for the sample average treatment effect of k vs k' (with all the potential outcomes as fixed). That is, contrasting k and k' instead of 1 and 0 as in the binary case. *(Hint: refer to the statistical theory for Neyman repeated sampling inference on pages 33-34 in Lecture 2).*

(d)

Propose an analog $\tau_{\mathrm{kk'}}$_hat to the difference-in-means estimator, for estimating $\tau_{\mathrm{kk'}}$.

(e)

Prove that $\tau_{\mathrm{kk'}}$_hat is unbiased for $\tau_{\mathrm{kk'}}$.

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