**PUBH 7485/8485**

**Homework 4**

The data for this assignment, as in the first three assignments, come from the obstetrics and periodontal therapy (OPT) study which tested whether or not treatment of maternal periodontal disease could reduce pre-term birth and improve other birth outcomes.

1. Consider estimating the average treatment effect among the treated. Again, please consider both outcomes (whether or not pregnancy ended before 37 weeks and birthweight) considered in the first assignment. Using the “final” outcome and treatment models from the first assignment, find the ATT using
   1. Regression adjustment with covariates
   2. Regression adjustment with propensity score
   3. Propensity score stratification
   4. Inverse probability weighting
   5. Propensity score matching (consider both 1:1 and 2:1 matching)
2. For the propensity score matching use tabular and graphical diagnostics to assess the quality of the matching. Please include a line plot of the SMD for each covariates (include the unmatched cohort and using IPW as well).

8485 Bonus Problems

1. Assume that the propensity score and outcome models are known. Show that the “doubly robust” augmented IPW estimator for E(Y^1) has smaller variance than the standard IPW estimator.
2. Show that if both the outcome and propensity score models are correctly specified, the limiting variance of the “doubly robust” augmented IPW estimator for E(Y^1) is the same regardless of whether the regression parameters in the outcome and propensity models are known or are estimated (using an M-estimator).