BIOS 667, Fall 2019, Final Exam (A)
December 4, 2019

The notation established in class will be used: $Y_{ij}, Y_i, Y, x_{ij}, X_i, X, b_i, \nu_{ij}, \mu_{ij}, K, G, R_i, \Sigma_i, \beta, \theta$, etc.

Use the files "respir03.sas" and "respir05.sas" and their output. Four models are fitted in "respir03.sas" and they are labelled $M_1, \cdots, M_4$. The data set is from problem 13.1. The responses of the ith subject are: $Y_{i0}, Y_{i1}, Y_{i2}, Y_{i3}, Y_{i4}$. Do not modify respir03.* in any way. You will need to edit and rerun "respir05.sas".

Do not present any computer code or straight copies of computer output, not even in an appendix. For hypothesis testing, report your calculations, the test statistic, degrees of freedom (if applicable), and the p-value.

1. In the context of model M_3, test the null hypothesis, H_0, that the effect of treatment on changes over time in the subject-specific log odds of good respiratory status is the same in the two clinics. The alternative hypothesis is the complement of H_0.

2. In the context of model M_2, test the null hypothesis, H_0, that treatment has no effect on changes over time in the subject-specific log odds of good respiratory status, after adjusting for possible clinic effects (including different time trends in the two clinics). The alternative hypothesis is the complement of H_0.

3. Comparing estimates from models M_2 and M_4, does there seem to be an *attenuation effect*? If so, how does its magnitude compare to the approximation formula?

4. Using estimates from model M_2, compute the marginal probability of good respiratory status in clinic 1 at time 1 (the first observation after baseline) for a patient in the placebo group. Repeat the calculation for a patient in the active treatment group (also in clinic 1 at time 1). How do these compare to the fitted values from model M_4? Hint: "respir05.sas".

5. Using estimates from model M_2, compute a decomposition of the total variance of the response into "between" and "within" components, and compute the fraction "between". Do this for a patient in the placebo group and, separately, for a patient in the active treatment group; both in clinic 1 and at time 1.

6. Using estimates from model M_2, estimate $\text{corr}(Y_{i0}, Y_{i1})$ for a subject in the placebo group in clinic 1.