Project 2 Description

The goal of this project is to conduct a simulation study investigating different properties of the linear mixed effects models. We have divided into three groups in class.  Below I describe Project 2 for each of the groups.  Given the different nature of this project, I will also post a project guide with the sections and page lengths for each section like what is provided in your syllabus for analysis projects.

**Group 1:** The purpose of your project is to investigate what happens to estimation of fixed effects, the standard error estimates of the fixed effects and the TypeI/II error for the fixed effects hypothesis testing when correlation is ignored when fitting the model.  The cases I would like simulated are: Number of subjects N=20 with 5 and 10 observations per subject. N=200 with 5 and 10 observations per subject. N=1000 with 5 and 10 observations per subject. At a minimum, please simulate a compound symmetry correlation structure, an AR(1) and unstructured correlation structure. In addition, simulation a random intercept and random intercept and slope models. We will consider a treatment covariate (1=treatment, 0=no treatment) and a time variable, where time goes from 0 to 4 as integers or 0 to 9 as integers for the two different cases. Time can be linearly increasing.  In addition, an interaction between time and group should be put into the simulation model. The treatment variable will represent a between-subject covariate and the time variable the with-in subject covariate.  In your results, please describe findings for each of the variables in your regression model. Note, here I have not prescribed the model error variance, the sizes of the beta's and the sizes of the correlations. We can decide this as a group in class the first week of your project.

**Group 2:** The purpose of your project is to investigate what happens to estimation of fixed effects, the standard errors estimates of the fixed effects and the TypeI/II error for the fixed effects hypothesis testing when the correlation is over- and under-specified.  Over-specified means you assumed in model fitting a correlation structure that is more complex than what exists in truth. Under-specified means you assumed in model fitting a correlation structure that is simpler than what exists in truth.The cases I would like simulated are: Number of subjects N=20 with 5 and 10 observations per subject. N=200 with 5 and 10 observations per subject. N=1000 with 5 and 10 observations per subject. At a minimum, please simulate a compound symmetry correlation structure, an AR(1) and unstructured correlation structure. In addition, simulation a random intercept and random intercept and slope models. For the random effects models start by simulating investigate an independent model error structure, but also simulate a more complex model error structure (like AR(1) or unstructured). We will consider a treatment covariate (1=treatment, 0=no treatment) and a time variable, where time goes from 0 to 4 as integers or 0 to 9 as integers for the two different cases. Time can be linearly increasing.  In addition, an interaction between time and group should be put into the simulation model. The treatment variable will represent a between-subject covariate and the time variable the with-in subject covariate.  In your results, please describe findings for each of the variables in your regression model.  Note, here I have not prescribed the model error variance, the sizes of the beta's and the sizes of the correlations. We can decide this as a group in class the first week of your project.

**Group 3:** The purpose of your project is to investigate what happens to estimation of fixed effects, the standard errors estimates of the fixed effects and the TypeI/II error for the fixed effects hypothesis testing when the random effects distribution is not normally distributed. The cases I would like simulated are: Number of subjects N=20 with 5 and 10 observations per subject. N=200 with 5 and 10 observations per subject. N=1000 with 5 and 10 observations per subject. Please simulate a random intercept and random intercept and slope models. For the random effects models start by simulating investigate an independent model error structure. The departures from normality should include a skewed distribution and a mixture distribution.  We will consider a treatment covariate (1=treatment, 0=no treatment) and a time variable, where time goes from 0 to 4 as integers or 0 to 9 as integers for the two different cases. Time can be linearly increasing.  In addition, an interaction between time and group should be put into the simulation model. The treatment variable will represent a between-subject covariate and the time variable the with-in subject covariate.  In your results, please describe findings for each of the variables in your regression model.  Note, here I have not prescribed the model error variance, the sizes of the beta's and the sizes of the correlations. We can decide this as a group in class the first week of your project.