**BIOS6643 Homework 5 2016**

*Practice (not to turn in):*

1. Re: polynomial trends for time and group\*time, come up with your own graphs and then indicate which polynomial trends exist. **Here is a challenge: can you come up with a curve that displays linear and quadratic and cubic trends simultaneously (for time)? Do you understand the difference between polynomial trends for time and polynomial trends for group\*time?**
2. For practice: try deriving *Var*(**b***i*) from the random effects slides.
3. For the Sleep data, finish constructing the **V***i* matrix when using the spatial power structure (we started it in class). For *ϕ*=0.5, determine the covariance matrix numerically, and compare it with a similar covariance matrix that applies the AR(1) on the 5 successive time points (as if they were equally spaced).

**Case 1: =**

**V**i=*Var*(**Y**i)= + =

AR(1) with 5 successive time points:

Case 2:

**G***i*=

**V**i=*Var*(**Y**i)= + =

Comparing AR(1) structure, the correlation will decrease quickly by using the spatial power.

*To turn in:*

1. Consider data collected at three times, morning, noon and evening over 3 straight days. Thus, each subject has 9 measurements. We discussed this scenario in class.
   1. Say that the outcome measure is y=cortisol, which is related to stress levels. Explain why just using the AR(1) structure for repeated measures might not be the best model for such data.

If we have repeated measures over time and the time in between measurements is equally spaced, we could use AR(1). But if the time between measurements is not equally spaced, and nested model may fit better in addition to AR(1).

* 1. If ‘morning’, ‘noon’ and ‘evening’ have consistent meanings across days, we can consider ‘day’ and ‘time of day’ as crossed factors that constitute two different types of repeated measures. Consider the AR(1)AR(1) Kronecker Product structure for these data (although it is not available in SAS, PROC MIXED). What is the correlation between the morning measurement on one day with the evening measurement on the following day (in terms of parameters)? NOTE: you can use ϕ and ρ as the correlation parameters for the 2 different time dimensions.

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The combined structure (Kronecker product structure):

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* 1. Suppose that we find the AR(1) structure for repeated measures within a day too restrictive. Suggest another Kronecker Product structure for the data, and determine the correlation between the morning measurement on one day with the evening measurement on the following day for your choice.

If AR(1) structure for repeated measures within a day too restrictive, we can use Toeplitz or UN structure. For example, we use UN@AR(1) structure.

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The combined structure (Kronecker product structure):

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1. Consider a study where families are recruited for a study where cholesterol levels of members within families are measured at two different times.
   1. Identify the levels of this 3-level data.
   2. If we include random *family* and *subject within family* terms and allow for UN structure for the error covariance matrix for subject *i*, write the **V***i* matrix for a family with 3 members involved in the study. (The dimension of the matrix should be 6×6.)