Purposes:

1. Team based assessment.
2. Demonstrate how to identify relevant information to meet the objectives of the ALA.
3. Assess student's ability to abstractly represent plant breeding activities and phenotypes in mathematical models.
4. Assess student's ability to manage data using simple spreadsheet functions.

Keywords:

Data model, Phenotypic Model

References:

"Review Models CM.pdf"

Sections 3.1 and 8.1 in Bernardo.

Applied Learning Activity:

Consider a soybean breeding program for Maturity Zone 2 in Iowa. The primary objective of this breeding program is genetic improvement of grain yield, as evidenced by annual releases of cultivars with grain yields that are at least 2% better than existing commercial varieties.

Next, let's consider the first stage of field trials. For this first stage you have sufficient budget to grow 10,000 plots in two environments located in close proximity to the breeding station. From the winter nurseries you have advanced a sample of 65 $F_{3:5}$ lines from each of 125 crosses. Samples of segregating lines derived from bi-parental crosses are often incorrectly referred to as populations. For this learning activity we adopt the use of family to describe samples of segregating lines derived from crosses of inbred lines. The pedigrees of the cultivars used in the bi-parental crosses are known. There is enough seed of each $F_{3:5}$ line to evaluate it for yield and maturity twice with 2-row plots. The breeding station is equidistant from two environments (Ames and Castana) that are distinct and represent the types of environments that are typical of your maturity zone market. The field variability within each of these locations requires that no more than 20 plots should be assigned to any block.

For this early stage field trial the breeder is primarily interested in evaluation of two traits, yield and maturity, both among and within the families.

1. Based on the field plot design agreed upon by the team, the objectives of the study, and the sampling scheme, model yield and maturity phenotypes for the sample of lines from the one of the families.
2. Use the phenotypic model, field plot design and traits to model the data.

    a. Based on your data model, develop an organized spreadsheet for the lines sampled from one family. Include variables representing all of the factors in the phenotypic model.

3. Add your quantitative measure of maturity (obtained from the ALA Review of Trait Measures) to the yield measurements from one family taken at both Castana and Ames ("Review Models Data Management ds1.xlsx") .

4. Combine all data for yield and maturity represented by this family into a single file. The column headings need to reflect all parameters in the phenotypic model.

It is possible to conduct a combined analysis across all lines from all families in all environments.

5. Model the phenotypes for a combined analysis across all 125 families.