

**Stat 402 B – Final Exam Take-home Problems**

Due at the beginning of the final exam period, Tuesday, May 6, 2014, 9:45 to 11:45 am.

When answering questions be sure to do so within the context of the problem.

1) [13 pts] You are asked to help design an experiment involving the germination of grass seed. The experiment will be conducted in a greenhouse in late winter/early spring. There are 2 factors of interest: type of grass seed (A: Kentucky Bluegrass or B: Perennial Ryegrass) and depth of soil on top of the seed (0 mm, 5 mm, and 10 mm). The seeds will be planted in flats (shallow rectangular wooden boxes). The flats are large enough to accommodate up to 1000 individual seeds of grass. The basic idea is to fill all the flats with 30 mm of soil to form a base. Grass seed (100 individual seeds) is then distributed on the base. More soil is put on top of the seed as specified by the level of depth factor. The response variable is the number of seeds that germinate.

   a) [1] What are the treatments? Be specific.
   b) [1] What are the experimental units?
   c) [2] Name an outside variable that should be controlled. Indicate how you would control the variable.
   d) [3] We wish to be able to detect a difference in treatment level means equal to 2.5 standard deviations with Alpha = 0.05 and Beta = 0.10. How many experimental units do we need for the experiment? With this amount of replication what are the sizes of detectable differences in factor level means?
   e) [3] Explain how you randomize and provide a randomized assignment of treatments to experimental units.
   f) [3] Give a partial ANOVA table listing all sources of variation and the associated degrees of freedom.

2) [12] The greenhouse calls and informs you that there is only enough room for 15 flats and those flats will be located at random within the greenhouse. Locations in the greenhouse can vary due to the amount of light and warmth.

   a) [2] If you proceed with the completely randomized design what contributes to the error source of variation in the experiment?
   b) [10] Describe how you would conduct a randomized complete block experiment using the 15 flats.
      i. Indicate how you would form blocks.
      ii. Explain in detail how you would use JMP to randomly assign treatments. Turn in a JMP data table with your randomized assignment.
      iii. Give a partial ANOVA table listing all sources of variation and the associated degrees of freedom.
      iv. What contributes to the error source of variation in the experiment?

3) [15] An alternative to a randomized complete block design is a split plot design. Describe how you would conduct a split plot experiment using 15 flats. In your description be sure to explain:
   i. What are the whole plots and the whole plot factor?
   ii. What are the sub plots and the sub plot factor?
   iii. Explain in detail how you would use random assignment.
   iv. Give a partial ANOVA table listing all sources of variation and the associated degrees of freedom.
   v. What contributes to the sources of variation used as error terms in the experiment?