

## Stat 402 B – Exam 2 Take-home Problems

Due in class Friday, April 10, 2009

1. [30 pts] You are asked to help design an experiment involving the growth of tomato plants from seed. The experiment will be conducted in a greenhouse in late winter/early spring. There are 2 factors of interest: type of soil (garden soil, potting soil, special seed starting soil) and variety of tomato (Rutgers, Big Boy, Early Girl). Seeds will be planted in individual containers. An individual container will be filled with a type of soil and 5 seeds of a particular variety will be planted (multiple seeds are used to ensure that at least one seed germinates). If more than one seed germinates, extra plants are removed so that only one plant remains in each container. The response variable is the height of the tomato plant one month after germination.

- a) [2] What are the conditions?
- b) [2] What are the treatments? Be specific.
- c) [1] What are the experimental units?
- d) [4] Name two outside variables that should be controlled. Indicate how you would control each of the variables that you mention.
- e) [3] We wish to be able to detect a difference in treatment level means equal to 2.0 standard deviations with  $\text{Alpha} = 0.05$  and  $\text{Beta} = 0.10$ . 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?
- f) [7] Describe how you would conduct a completely randomized experiment to examine the two factors of interest and their interaction.
  - i. Explain how you would randomize and provide a JMP data table with your randomized assignment of units to treatments.
  - ii. Give a partial ANOVA table listing all sources of variation and the associated degrees of freedom.

When you go to the green house to run your experiment you discover that the large rectangular area assigned to you does not get consistent light from north to south. You also notice that there is a heat source at the east end of the area and a door to the outside at the west end of the table.

- g) [4] Explain why a Latin Square design would be more appropriate given the layout of the greenhouse. Be sure to indicate what the nuisance factors are.
- h) [7] Describe how you would conduct the experiment using a Latin Square design.
  - i. Explain in detail how you would randomize and provide a randomized Latin Square.
  - ii. Give a partial ANOVA table listing all sources of variation and the associated degrees of freedom.