## Stat 666 HW #3a Due Date: TBA

- 1. #6.6 in RC
- 2. The file snapbean.dat gives data from a two-way (fixed-effects MANOVA) on snap beans showing the results of four variables:  $x_1$  = yield earliness,  $x_2$  = specific leaf area (SLA) earliness,  $x_3$  = total yield, and  $x_4$  = average SLA. The factors are sowing date (S) and variety (V). The columns of the file are: sowing-date, variety, replicate,  $x_1$ ,  $x_2$ ,  $x_3$ , and  $x_4$ . SAS should be used to carry out the bulk of the analysis. For each of the following aspects of the analysis, describe and interpret your analysis. Attach your SAS command statements. [FYI: This problem is similar to problem 6.28 in RC]
  - (a) Test for main effects for S and V and for the S\*V interaction. For each of the three tests, consider the eigenvalues of  $\mathbf{E}^{-1}\mathbf{H}$ , where  $\mathbf{E}$  and  $\mathbf{H}$  are the appropriate "within" and "between" sums of squares and cross-products matrices. From an inspection of this matrix, which of the 4 MANOVA statistics would you expect to be most powerful? Why?
  - (b) Compare variety 2 with the average of varieties 1 and 3 using a test on a single contrast.
  - (c) Test linear, quadratic, and cubic contrasts for sowing date.
  - (d) Test for the significance of  $x_3$  and  $x_4$  above and beyond the contribution of  $x_1$  and  $x_2$  in assessing the main effects and interaction.
  - (e) Which variables are most important in separating the means for sowing date? What about variety? What about the interaction?
  - (f) Consider pairwise comparisons of the varieties for all 4 response variables. Use the Bonferroni approach to protect the overall experimentwise error rate.