

Math 356H Assignment #5

Readings:

- Week 9 (Mar. 10 - Mar. 14). **More on Single Factor ANOVA.**
 - (D) Section 10.3.
 - *Optional:* (NWK) Chapters 16 and 17 develop ANOVA as a linear model, as in Section 10.3 (not included in *Linear Regression Models*). This way of thinking about ANOVA makes it clear why ANOVA is covered in a class about linear models. Moreover, it is really the only way of thinking about ANOVA as the models become more complicated, since the formulas become impossible (see Section 11.3 of Devore).
- Week 10 (Mar. 17 - Mar. 21). **Two-Factor ANOVA.**
 - No office hours on Friday: Good Friday.
 - (D) Sections 11.1 and 11.2.
 - (NWK) Section 20.1 to 20.4. Section 20.8 gives the regression (with matrices) approach to ANOVA.

Due date: Wednesday, March 26.

1. Chapter 10, #24.
2. Chapter 10, #27.
3. Rat poison is normally made by mixing its active chemical ingredients with ordinary cornmeal. In many urban areas, though, rats can find food that they prefer to cornmeal, so the poison is left untouched. One solution is to make the cornmeal more palatable by adding food supplements such as peanut butter or meat. Doing that is effective, but the cost is high and the supplements spoil quickly.

In Milwaukee, a study was carried out to see whether artificial food supplements might be a workable compromise. For five two-week periods, thirty-two hundred baits were placed around garbage-storage areas: eight hundred consisted of plain cornmeal; a second eight hundred had cornmeal mixed with artificial butter-vanilla flavoring; a third eight hundred contained cornmeal mixed with artificial roast beef flavoring; and the remaining eight hundred were cornmeal mixed with artificial bread flavoring.

The following table lists, for each survey, the percentage of each type of bait that was eaten.

| Survey number | Plain | Butter vanilla | Roast beef | Bread |
|---------------|-------|----------------|------------|-------|
| 1 | 13.8 | 11.7 | 14.0 | 12.6 |
| 2 | 12.9 | 16.7 | 15.5 | 13.8 |
| 3 | 25.9 | 29.8 | 27.8 | 25.0 |
| 4 | 18.0 | 23.1 | 23.0 | 16.9 |
| 5 | 15.2 | 20.2 | 19.0 | 13.7 |

- (a) What is the factor? How many levels are in this design?
 - (b) What is the blocking factor?
 - (c) Do the rats show any preferences for the different flavors?
 - (d) Were the blocks helpful in reducing the error sum of squares?
 - (e) If a follow-up study were to be done, comparing these same baits, should a completely randomized design or a randomized block design be used?
4. A particular county employs three assessors who are responsible for determining the value of residential property in the county. To see whether these assessors differ systematically in their assessments, 5 houses are selected, and each assessor is asked to determine the market value of each house. With factor A denoting assessors ($I = 3$) and blocking factor B denoting houses ($J = 5$), suppose $SSA = 11.7$, $SSB = 113.5$, and $SSE = 25.6$.

- (a) Test the hypothesis that there are no systematic differences among assessors.
- (b) Explain why a randomized block experiment with only 5 houses was used rather than a one-way ANOVA experiment involving a total of 15 different houses with each assessor asked to assess 5 different houses (a different group of 5 for each assessor).
- (c) Suppose now that the houses had actually been selected at random from among those of a certain age and size, so that factor B is random rather than fixed. Test $H_0 : \sigma_B^2 = 0$ using a level .01 test.

5. Chapter 11, #16.

6. Chapter 11, #20.