**SAS lecture 5 – Chapter 17 Fixed, Random and Mixed Effect**

1. Consider the problem we used to illustrate a one-factor experiment with random

treatment effects. Two graduate students working for a professor in electrical engineering

have been funded to record lightning discharge intensities (intensities of the electrical field) at three tracking stations. Because of the high frequency of thunderstorms in the summer months (in Florida, storms occur on 80 or more days per year), the graduate students were to choose a point at random on a map of the 20-mile-radius region and assemble their tracking equipment (provided they could get permission of the property owners). Each day during the hours from 8 A.M. to 5 P.M., they were to monitor their instruments until the maximum intensity had been recorded for five separate storms. They then repeated the process separately at the two other locations chosen at random.

a. Write an appropriate statistical model, defining all terms.

b. Perform an analysis of variance and interpret your results. Use α= .05.

c. Estimate the variance components and their proportional allocation of the total variability.

d. If one were to treat the main factor fixed, does the conclusion change?

Data:

Station Intensities

1 20

1 1050

1 3200

1 5600

1 50

2 4300

2 70

2 2560

2 3650

2 80

3 100

3 7700

3 8500

3 2960

3 3340

2. It is important in battery testing to consider different temperatures and modes of use; a battery that is superior at one temperature and mode of use is not necessarily superior at other treatment combination. The batteries were being tested at 4 different temperatures for three modes of use (I for intermittent, C for continuous, S for sporadic). Analyze the data.

Battery Lifetime (2 replicates)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Model | Temperature | | | |
| 1 | 2 | 3 | 4 |
| I | 12, 16 | 15, 19 | 31, 39 | 53, 55 |
| C | 15, 19 | 17, 17 | 30, 34 | 51, 49 |
| S | 11, 17 | 24, 22 | 33, 37 | 61, 67 |

1. Write an appropriate statistical model, defining all terms.
2. Perform an analysis of variance and interpret your results. Use α= .05.
3. Estimate the variance components and their proportional allocation of the total variability.
4. If one were to treat the main factor fixed, does the conclusion change?

Data: 12 16 15 19 31 39 53 55 15 19 17 17 30 34 51 49 11 17 24 22 33 37 61 67