

QUEEN MARY, UNIVERSITY OF LONDON

MAS 314

Design of Experiments

Assignment 11

For discussion on 27 March 2007

1 Consider the data set in Question 1 of Assignment 4. Use the factors *fumigant*, *dose* and *type* to decompose the treatment sum of squares into four parts, and calculate the corresponding tables of means. Use this information, together with that calculated in Question 1 of Assignment 5 (or Question 6 of Practical 6), to interpret the complete analysis of variance.

2 In the experiment discussed in Section 7.2, four feed treatments were tested on 80 calves. The calves were kept in 8 pens, 10 animals per pen. The feeds were all combinations of two types of hay with two types of cake. Each type of hay was put into four pens for the calves to eat ad lib. Each type of cake was given to 5 calves in each pen.

- (a) Draw the Hasse diagram for the factors on the plots (ignoring treatment factors).
- (b) Draw the Hasse diagram for the factors on the treatments.
- (c) Write down the skeleton analysis-of-variance table.

3 In an experiment into the digestibility of stubble, four feed treatments are to be applied to sheep. There are 16 sheep, in four rooms of four animals each. There are four test periods of four weeks each, separated by two-week recovery periods. Each sheep is to be fed all treatments, one in each test period. During the recovery periods all animals will receive their usual feed, so that they will return to normal conditions before being subjected to a new treatment.

Draw the Hasse diagram for the non-treatment factors involved. Describe how you would construct a suitable design and randomize it. Write down the skeleton analysis of variance table, showing stratum, source and degrees of freedom.

4 Consider the word-processing experiment in Question 1 of Assignment 8. Now suppose that only one copy of each word-processor is available, so that the experiment must last three weeks. The typists will be split into three groups according to experience; each week one group will try out the word-processors.

Furthermore, we now know that the word-processors are of two kinds. Three are WYSIWYG and two are SGML.

- (a) Draw the Hasse diagram for the factors on the plots (ignoring treatment factors).
- (b) Draw the Hasse diagram for the factors on the treatments.
- (c) Describe how to construct the design for the experiment.
- (d) Describe how to randomize the design.
- (e) Construct the skeleton analysis-of-variance table.

5 Show that $\{1, 3, 4, 5, 9\}$ is a perfect difference set modulo 11.

6 For each of the following sets of values of t , b and k , *either* construct a balanced incomplete-block design for t treatments in b blocks of size k *or* prove that no such balanced incomplete-block design exists.

- (a) $t = 5 \quad b = 10 \quad k = 3$
- (b) $t = 7 \quad b = 14 \quad k = 3$
- (c) $t = 10 \quad b = 15 \quad k = 3$
- (d) $t = 11 \quad b = 11 \quad k = 5$
- (e) $t = 21 \quad b = 14 \quad k = 6$
- (f) $t = 25 \quad b = 30 \quad k = 5$
- (g) $t = 25 \quad b = 40 \quad k = 5$
- (h) $t = 31 \quad b = 31 \quad k = 6$