

## Series 4

1. In an experiment the effect of three feed compositions on the concentration of a particular hormone in cattle was investigated. There were 9, 12, and 11 cows respectively in the three treatment groups, and for every cow the concentration of the hormone was measured before the start of the experiment and again after a certain period of feeding with experimental compositions. The data are in the file `feed.txt`.
  - a) Test for treatment differences without taking into account the initial hormone concentration. Estimate the treatment means.
  - b) Carry out a one-way analysis of variance for the differences  $D_i = Y_i - x_i$  of hormone measurements, where  $Y_i$  is the response after treatment and  $x_i$  the baseline measurement.
  - c) Include the baseline measurement in the model as a covariate and do an analysis of covariance for the responses  $Y_i$ . Estimate the adjusted treatment means.
  - d) Compare and comment the different results.
  
2. Take the first replicate of the design of Question 3 in Exercise 3 and divide it into blocks of size 8 with ABCD confounded.
  
3. Construct a design to test 5 two-level factors in 8 runs.
  
4. In a study of a high-speed weaving process, four factors thought to influence fabric strength are selected for study: side-to-side differences in strength, yarn type, pick density and air pressure. Each factor was studied at two levels (+,-). The data are:

Side-to-side	Yarn type	Pick density	Air pressure	Strength
-	-	-	-	24.50
+	-	-	+	22.05
-	+	-	+	24.52
+	+	-	-	25.00
-	-	+	+	25.68
+	-	+	-	24.51
-	+	+	-	24.68
+	+	+	+	24.23

- a) Find  $n$  und  $k$  for this  $2^{n-k}$  – design.
- b) Determine the alias structure of this design.
- c) Calculate estimates of the effects.
- d) Suppose that additional experimentation shows that only effects whose magnitudes exceed 0.35 are important. Which factors or interactions have a significant effect on fabric strength?
- e) Suppose that additional experiments show that the AB and AD interactions are not significant. If the objective of the study is to maximize fabric strength, what setting of each factor do you recommend?

**Preliminary discussion:** 19.11.2012.

**Deadline:** 26.11.2012.