7.9 Problems

7.1. Consider the experiment described in Problem 6.1. Analyze this experiment assuming that each replicate represents a block of a single production shift.

7.2. Consider the experiment described in Problem 6.5. Analyze this experiment assuming that each one of the four replicates represents a block.

7.3. Consider the alloy cracking experiment described in Problem 6.15. Suppose that only 16 runs could be made on a single day, so each replicate was treated as a block. Analyze the experiment and draw conclusions.

7.4. Consider the data from the first replicate of Problem 6.1. Suppose that these observations could not all be run using the same bar stock. Set up a design to run these observations in two blocks of four observations each with *ABC* confounded. Analyze the data.

7.5. Consider the data from the first replicate of Problem 6.7. Construct a design with two blocks of eight observations each with *ABCD* confounded. Analyze the data.

7.6. Repeat Problem 7.5 assuming that four blocks are required. Confound *ABD* and *ABC* (and consequently *CD*) with blocks.

7.7. Using the data from the 2^5 design in Problem 6.26, construct and analyze a design in two blocks with *ABCDE* confounded with blocks.

7.8. Repeat Problem 7.7 assuming that four blocks are necessary. Suggest a reasonable confounding scheme.

7.9. Consider the data from the 2^5 design in Problem 6.26. Suppose that it was necessary to run this design in four blocks with *ACDE* and *BCD* (and consequently *ABE*) confounded. Analyze the data from this design.

7.10. Consider the fill height deviation experiment in Problem 6.18. Suppose that each replicate was run on a separate day. Analyze the data assuming that days are blocks.

7.11. Consider the fill height deviation experiment in Problem 6.20. Suppose that only four runs could be made on each shift. Set up a design with *ABC* confounded in replicate 1 and *AC* confounded in replicate 2. Analyze the data and comment on your findings.

7.12. Consider the potting experiment in Problem 6.21. Analyze the data considering each replicate as a block.

7.13. Using the data from the 2^4 design in Problem 6.22, construct and analyze a design in two blocks with *ABCD* confounded with blocks.

7.14. Consider the direct mail experiment in Problem 6.24. Suppose that each group of customers is in a different part of the country. Suggest an appropriate analysis for the experiment.

7.15. Consider the isatin yield experiment in Problem 6.38. Set up the 2^4 experiment in this problem in two blocks with ABCD confounded. Analyze the data from this design. Is the block effect large?

7.16. The experiment in Problem 6.39 is a 2^5 factorial. Suppose that this design had been run in four blocks of eight runs each.

(**a**) Recommend a blocking scheme and set up the design.

(**b**) Analyze the data from this blocked design. Is blocking important?

7.17. Repeat Problem 6.16 using a design in two blocks.

7.18. The design in Problem 6.40 is a 2^4 factorial. Set up this experiment in two blocks with ABCD confounded. Analyze the data from this design. Is the block effect large?

7.19. The design in Problem 6.42 is a 2^3 factorial replicated twice. Suppose that each replicate was a block. Analyze all of the responses from this blocked design. Are the results comparable to those from Problem 6.42? Is the block effect large?

7.20. Design an experiment for confounding a 2^6 factorial in four blocks. Suggest an appropriate confounding scheme, different from the one shown in Table 7.8.

7.21. Consider the 2^6 design in eight blocks of eight runs each with *ABCD, ACE*, and *ABEF* as the independent effects chosen to be confounded with blocks. Generate the design. Find the other effects confounded with blocks.

7.22. Consider the 2^2 design in two blocks with *AB* confounded. Prove algebraically that $SS_{AB} = SS_{\text{Blocks}}$.

7.23. Consider the data in Example 7.2. Suppose that all the observations in block 2 are increased by 20. Analyze the data that would result. Estimate the block effect. Can you explain its magnitude? Do blocks now appear to be an important factor? Are any other effect estimates impacted by the change you made to the data?

7.24. Suppose that in Problem 6.1 we had confounded *ABC* in replicate I, *AB* in replicate II, and *BC* in replicate III. Calculate the factor effect estimates. Construct the analysis of variance table.

7.25. Repeat the analysis of Problem 6.1 assuming that *ABC* was confounded with blocks in each replicate.

7.26. Suppose that in Problem 6.7 *ABCD* was confounded in replicate I and *ABC* was confounded in replicate II. Perform the statistical analysis of this design.

7.27. Construct a 2^3 design with *ABC* confounded in the first two replicates and *BC* confounded in the third. Outline the analysis of variance and comment on the information obtained.