THE DESIGN AND MIXED-MODEL ANALYSIS OF EXPERIMENTS

PRACTICAL VIII SOLUTIONS

VIII.1 The following layout is that appropriate to an experiment in which the same four intervals and the same four areas are used to repeat testing of four samplers. The assignment of samplers to intervals and areas was accomplished using a Latin Square on each of the two days the testing is conducted.

	Day							
	1				2			
Interval	1	2	3	4	1	2	3	4
Area								
1	C	D	B	A	C	D	B	A
2	D	B	A	C	D	B	A	C
3	A	C	D	B	A	C	D	B
4	B	A	C	D	B	A	C	D

Use Genstat to verify that the analysis given in class is the appropriate one for this experiment. You will need to set up the factor information, the block and treatment structure and enter an ANOVA command without any options or parameters. The latter command produces the *dummy analysis*.

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Genstat 5  Release 4.1  (PC/Windows NT)              29 March 2000 16:06:29
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                Genstat 5 Fourth Edition - (for Windows)
                Genstat 5 Procedure Library Release PL11
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  3  "Data taken from File: D:/ANALYSES/LM/ONEFAC/LSREPEAT.GSH"
  4  DELETE [redefine=yes] Day,Interval,Area,Samplers
  5  FACTOR [modify=yes;nvalues=32;levels=2] Day
  6  READ Day; frepresentation=ordinal

   Identifier    Values   Missing    Levels
          Day        32         0         2

  8  FACTOR [modify=yes;nvalues=32;levels=4] Interval
  9  READ Interval; frepresentation=ordinal

   Identifier    Values   Missing    Levels
     Interval        32         0         4

 11  FACTOR [modify=yes;nvalues=32;levels=4] Area
 12  READ Area; frepresentation=ordinal

   Identifier    Values   Missing    Levels
         Area        32         0         4

 14  FACTOR [modify=yes;nvalues=32;levels=4] Samplers
 15  READ Samplers; frepresentation=ordinal
```

```
   Identifier    Values   Missing    Levels
     Samplers        32         0         4

 17
 18  BLOCK Day*Interval*Area
 19  TREAT Samplers
 20  PDESIGN

*** Treatment combinations on each unit of the design ***


             Area   1   2   3   4
     Day Interval
       1        1   3   4   1   2
                2   4   2   3   1
                3   2   1   4   3
                4   1   3   2   4
       2        1   3   4   1   2
                2   4   2   3   1
                3   2   1   4   3
                4   1   3   2   4

 Treatment factors are listed in the order: Samplers

 21  ANOVA


21.....................................................................

***** Analysis of variance *****
Source of variation     d.f.

Day stratum                1

Interval stratum           3

Area stratum               3

Day.Interval stratum       3

Day.Area stratum           3

Interval.Area stratum
Samplers                   3
Residual                   6

Day.Interval.Area stratum
                           9

Total                     31
```

VIII.2 In exercise VI.4 you considered the power of an experiment to investigate the effects of four different rations on the apparent consumption of total carbohydrates (as a percentage) by calves. The design used a 4×4 Latin square. The values used in obtaining the power were that the experimenter is willing to run a 5% chance of making a type I error and would like to have a 95% chance of detecting any difference of 7.5% or more in the apparent consumption between rations. A variance of 10% for the animal-period combinations is expected in the experiment. For this design it was computed that the power would be just over 0.5 — not nearly enough!

Suppose the experimenter could obtain another 4 animals and so conduct the experiment with 8 animals over the 4 periods. Would this experiment have at least the level of power desired?

ANOVAPower.xls is used to compute the power and the values in the cells below the headings are as follows. Note that because the same periods but different animals is to be used, the degrees of freedom of the denominator are those for the Residual in case 2 in the lecture notes.

sample size (r)	alpha	DF numer-ator	DF denomin-ator	central F	no. values in a mean (m)	delta	standard deviation	lambda	power
8	0.05	3	15	3.2874	8	7.5	3.162278	22.5	0.9501

The power is just above the desired 95%.