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Section 1

MANE 6313

Subsection 1

Week 8, Module C

Student Learning Outcome

- Select an appropriate experimental design with one or more factors,
- Select an appropriate model with one or more factors,
- Evaluate statistical analyses of experimental designs,
- Assess the model adequacy of any experimental design, and
- Interpret model results.

Module Learning Outcome

Creating design with more than two blocks.

Confounding the 2^k design ~~in 4 blocks~~

- You must define 2 linear combinations L_1 and L_2
- For each treatment effect, we construct the ordered pair (L_1 mod 2, L_2 mod 2)
- This will result in four blocks having values (0,0), (0,1), (1,0) and (1,1)
- Work a 2^4 example in 4 blocks

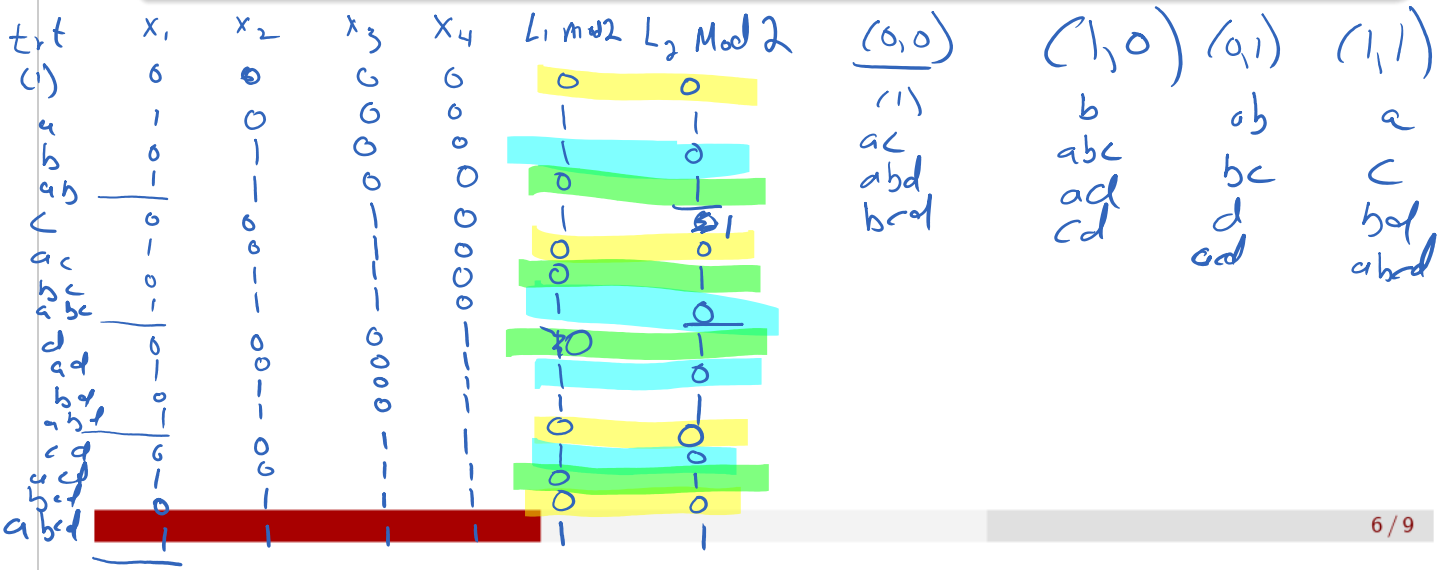
$L_1 = ABC = 1x_1 + 1x_2 + 1x_3 + 0x_4$

$L_2 = ACD = 1x_1 + 0x_2 + 1x_3 + 0x_4$

$L_1 = 1x_1 + 1x_2 + 1x_3 + 0x_4$

$L_2 = 1x_1 + 0x_2 + 1x_3 + 1x_4$

Four Block Example (L_1, L_2)



Source | Anova d.f.
Block | 4-1=3

Generalized Interactions

- Examining the example problem, we see three degrees of freedom for blocks (4-1). One degree can be associated with ABC and the second with BCD. There is a missing effect.
- There is a generalized interaction that occurs when two or more linear combinations are used.
- $GI = ABC(ACD) = A^2BC^2D = BD$
- Care must be exercised in selecting L_1 and L_2 because the GI might contain important information.

Confounding the 2^k Design in 2^p Blocks

- Select p independent effects to be confounded.
- Independent effects means that no effect chosen is the generalized interaction of the others.
- The p defining contrasts $L_1, L_2, \ldots, L_p$ are used to define the 2^p blocks
- In addition, there are exactly $2^p - p - 1$ other effects confounded with these blocks.
- Often people look to tables such as Table 7.9 on page 322 for helping in selecting the effects used to generate blocks

all combinations of blocking generators

Table 7.9

■ **TABLE 7.9**
Suggested Blocking Arrangements for the 2^k Factorial Design

Number of Factors, k	Number of Blocks, 2^p	Block Size, 2^{k-p}	Effects Chosen to Generate the Blocks	Interactions Confounded with Blocks
3	2	4	ABC	ABC
	4	2	AB, AC	AB, AC, BC
4	2	8	$ABCD$	$ABCD$
	4	4	ABC, ACD	ABC, ACD, BD
	8	2	AB, BC, CD	$AB, BC, CD, AC, BD, AD, ABCD$
5	2	16	$ABCDE$	$ABCDE$
	4	8	ABC, CDE	$ABC, CDE, ABDE$
	8	4	ABE, BCE, CDE	$ABE, BCE, CDE, AC, ABCD, BD, ADE$
	16	2	AB, AC, CD, DE	All two- and four-factor interactions (15 effects)
6	2	32	$ABCDEF$	$ABCDEF$
	4	16	$ABCF, CDEF$	$ABCF, CDEF, ABDE$
	8	8	$ABEF, ABCD, ACE$	$ABEF, ABCD, ACE, BCF, BDE, CDEF, ADF$
	16	4	ABF, ACF, BDF, DEF	$ABF, ACF, BDF, DEF, BC, ABCD, ABDE, AD, ACDE, CE, CDF, BCDEF, ABCEF, AEF, BE$
	32	2	AB, BC, CD, DE, EF	All two-, four-, and six-factor interactions (31 effects)
7	2	64	$ABCDEFG$	$ABCDEFG$
	4	32	$ABCFG, CDEFG$	$ABCFG, CDEFG, ABDE$
	8	16	$ABCD, CDEF, ADFG$	$ABC, DEF, AFG, ABCDEF, BCFG, ADEG, BCDEG$
	16	8	$ABCD, EFG, CDE, ADG$	$ABCD, EFG, CDE, ADG, ABCDEFG, ABE, BCG, CDFG, ADEF, ACEG, ABFG, BCEF, BDEG, ACF, BDF$
	32	4	ABG, BCG, CDG, DEG, EFG	$ABG, BCG, CDG, DEG, EFG, AC, BD, CE, DF, AE, BF, ABCD, ABDE, ABEF, BCDE, BCEF, CDEF, ABCDEFG, ADG, ACDEG, ACEFG, ABDFG, ABCEG, BEG, BDEFG, CFG, ADEF, ACDF, ABCF, AFG, BCDFG$