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Section 1

MANE 6313

Subsection 1

Week 9, Module G

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

Describe fold-over designs.

Sequential Experimentation

- This is particularly applicable for resolution III experiments
- To separate an interesting effect, e.g. C, go to the appropriate column and change the signs. This is one type of fold-over
- In general, the main effect C will not be aliased with any other two-factor interactions
  - In general, all two-factor interactions involving C will not be aliased with other two-factor interactions
- A full fold-over occurs when you change all the signs in the design matrix.
- This will break the alias links between the main effects and two factor interactions
  - Two-factor interactions may be aliased with each other

Fold-over on Factor D
(I found confusing in textbook).
Data is given on table 8-19 on page 362.

Main Effects estimates are given in (2)

$l_A \rightarrow A + BD + CE + FG$

$l_B \rightarrow B + AD + CF + EG$

⋮

$l_G \rightarrow G + CD + BE + AF$

Investigate Factor D. Conduct a 2nd $\frac{1}{16}$ fraction

run	A	B	C	D = AB (change sign)	E = AC	F = BC	G = ABC
1	−	−	−	+ → −	+	+	−
2	+	−	−	− → +	−	+	+
3	−	+	−	− → +	+	−	+
4	+	+	−	+ → −	−	−	−
5	−	−	+	+ → −	−	−	+
6	+	−	+	− → +	+	−	−
7	−	+	+	− → +	−	+	−
8	+	+	+	+ → −	+	+	+

To adjust aliasing scheme, everywhere you see a D in the aliasing scheme from the first fraction, change the sign

1st fraction

$l_A \rightarrow A + BD + CE + FG$

$l_B \rightarrow B + AD + CF + EG$

2nd fraction

$l'_A \rightarrow A - BD + CE + FG$

$l'_B \rightarrow B - AD + CF + EG$

The only tricky part is for D

$$l'_{-D} = -D + AB + CG + EF$$

This is equivalent to

$$l'_D = D - AB - CG - EF$$

Examine linear combinations of l & l' on pg. 364

Notice D & all 2-factor interactions with D.

Defining Relations for the Fold-over

- Examine all of the defining relations (including G.I.'s). If the word length is odd, change the sign for the fold-over, otherwise leave sign alone
- Montgomery shows a method to determine the defining relations for the (combined) fold-over experiment

Full Foldover (Example 8-7 orig pg 365)

1st Fraction
Generators: $I = ABD$, $I = ACE$, $I = BCF$, $I = ABCG$

Experimenter chooses to do a "Full Foldover".

Examine table 8-21 & 8-22 for settings for both fractions

Generators for 2nd fraction

$I = (-A)(-B)(-D) = -ABD$
$I = (-A)(-C)(-E) = -ACE$
$F = (-B)(-C)(-F) = -BCF$
$I = (-A)(-B)(-C)(-G) = ABCG$

From this, we can find aliasing scheme for 2nd fraction and then analyze combined fraction.

See page 366

Plackett-Burman Designs

- These designs are two-level fractional factorial designs for studying $k = N - 1$ variables in N runs where N is a multiple of 4.
- If N is a power of 2, Plackett-Burman designs are equivalent to resolution III experiments
- For $N = 12, 20, 24, 28, 36$ these designs may be of interest. This set of Plackett-Burman designs is said to be a *nongeometric design*
- The nongeometric designs have very messy alias structures and may not project well.