

last time, we had a 2^{6-2}_{III} design

Stat 565
2-20-18

with $I = ABCD = CDEF = ABDEF$

①

Which 16 runs do we conduct?

Project the 2^{6-2} design onto a 2^4 design

| A | B | C | F | D=ABC | E=AEF | |
|---|---|---|---|-------|-------|-------------------------|
| - | - | - | - | - | - | $A = BCD = ACDEF = BEF$ |
| + | - | - | - | + | + | $B = ACD = BCDEF = AEF$ |
| + | + | - | - | + | + | $C = ABD = DEF = ABCF$ |
| + | + | + | - | - | + | $D = ABC = CEF = ABDEF$ |
| - | + | + | + | + | + | $E = ABCE = CDF = ABF$ |
| + | + | + | + | + | + | $F = ABCDF = CDE = ABE$ |
| - | + | + | + | + | + | |
| + | - | + | + | + | - | |
| + | - | - | + | + | + | |
| - | - | - | + | + | + | |
| - | - | + | - | - | - | |
| + | - | + | - | - | - | |
| + | + | + | - | - | - | |
| + | + | + | + | + | + | |

Our 16 runs are:

②

(i)

ade

bde

ab etc.

⋮

abedaf

What if we need to do this experiment in 2 blocks?

Find an effect to confound with blocks. Make

sure that this effect is not aliased with a main effect. ACE would work.

Make an ACE column. Run the -'s in 1 block,
+ the +'s in the other.

Example: Design a 2^{7-4} experiment.

(3)

Use Table X on p. 708 to set up a 2^{7-4}_{III} design.

Project onto a 2^3 design.

| A | B | C | D=AB | E=AC | F=BC | G=CD | runs to do |
|---|---|---|------|------|------|------|------------|
| - | - | - | + | + | + | - | def |
| + | - | - | - | - | + | + | atg |
| - | + | - | - | + | - | + | beg |
| + | + | - | + | - | - | - | abd |
| - | - | + | + | - | - | + | cdg |
| + | - | + | - | + | - | - | ace |
| - | + | + | - | - | + | - | bef |
| + | + | + | + | + | + | + | abcdefg |

ANOVA:

| Source | df |
|--------|----|
| A | 1 |
| B | 1 |
| C | 1 |
| D | 1 |
| E | 1 |
| F | 1 |
| G | 1 |
| Total | 7 |

To get some error df, the best method would be to run a few center points.

If another 8 runs are possible, then you should have designed a 2^{7-3}_{IV} experiment.

(4)

After these 8 runs have been done, if you wanted to duplicate it, you would gain 8 df for error.

If you choose to replicate, do a
fold-over replication.

(5)

Note that $A = BD = CE = FG$

What if we could alias A with $-BD, -CE, -FG$
on the replication?

To do this, reverse the sign of every letter in
each of your generator words. Now

$I = -ABD = -ACE = BCD = -BCF$ etc.

Now do these 8 new runs.

More detail:

| Source | df |
|----------|----|
| A | 1 |
| A^2 | 1 |
| B | 1 |
| B^2 | 1 |
| AB | 1 |
| A^2B | 1 |
| AB^2 | 1 |
| A^2B^2 | 1 |
| Total | 8 |

What if our 3^2 design
needs to be run in 3 blocks
of 3 obs each? (6)

Choose AB^2 to be confounded
with blocks.

Its inverse element, A^2B ,
will also be confounded.

3^k designs

k factors, 3 levels each

(7)

Example: Set up a 3^2 design

9 runs

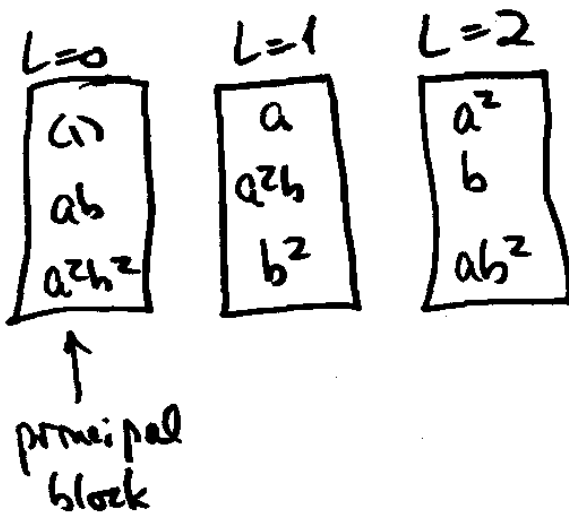
| A | B | runs | L |
|---|---|-------------------------------|---|
| 0 | 0 | (1) | 0 |
| 1 | 0 | a | 1 |
| 2 | 0 | a ² | 2 |
| 0 | 1 | b | 2 |
| 1 | 1 | ab | 0 |
| 2 | 1 | a ² b | 1 |
| 0 | 2 | b ² | 1 |
| 1 | 2 | ab ² | 2 |
| 2 | 2 | a ² b ² | 0 |

| Source | df |
|--------|----|
| A | 2 |
| B | 2 |
| AB | 4 |
| ERR | 0 |
| TOT | 8 |

(8)

Since AB is to be confounded, let

$$L = x_1 + 2x_2 \pmod{3}$$



| Source | df |
|-------------------------------|----|
| A | 1 |
| A ² | 1 |
| B | 1 |
| B ² | 1 |
| AB | 1 |
| A ² B ² | 1 |
| Blocks | 2 |
| Total | 8 |

Example: Design a 3^4 experiment in 9 blocks (9)

Say we choose ABC and AB^2D^2 to be confounded with blocks.

Make a list of all effects confounded with blocks

| | |
|-----------|-------------|
| ABC | $A^2B^2C^2$ |
| AB^2D^2 | A^2BD |
| A^2CD^2 | AC^2D |
| B^2CD | BC^2D^2 |

Next time: Which runs go into each block?