

Blocking and Confounding for Unreplicated 2^k Factorial Design

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12/28/2022

Introduction

In many situations, it is impossible to perform all of the runs in a 2^k factorial experiment under homogeneous conditions such as batch size not being large enough. In order to deal with the potential confounding introduced by using multiple batches, subsets of trial runs can be used. Depending on the blocking applied, the confounding to be reduced (usually to higher order interactions).

Rule of Thumb

If you have the levels categorized as positive and negative, the product of the main effect factor's level will output a positive or negative. Assign blocks based on those results. Typically all of the main effects will be in one group.

■ 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	$ABG, BCG, CDG, DEG, EFG, AC, BD, CE, DF, AE, BF, ABCD, ABDE, ABEF, BCDE, BCEF, CDEF, ABCDEFG, ADG, ACDEG, ACEFG, ABDFG, ABCEG, BEG, BDEFG, CFG, ADEF, ACDF, ABCF, AFG, BCDFG$
	64	2	AB, BC, CD, DE, EF, FG	All two-, four-, and six-factor interactions (63 effects)

Figure 1: Confounding Table