Chapter 882

Fractional Factorial Designs

Introduction

This program generates two-level fractional-factorial designs of up to sixteen factors with blocking. Reports show the aliasing pattern that is used. The design rows may be output in standard or random order. The design data generated by this procedure can be produced in a spreadsheet as well as the output window.

When generating a design, the program first checks to see if the design is among those listed on page 410 of Box, Hunter, and Hunter (1978). If the requested design is not listed in the above book, the design pattern is determined using the standard procedure in which the highest-order interactions are confounded first, and so on. The procedure creates the design such that main effects are not aliased with each other.

An introduction to experimental design is presented in Chapter 881 on Two-Level Designs and will not be repeated here.

Example 1 – Fractional Factorial Design

This section presents an example of how to generate an experimental design using this program. **CAUTION: since the purpose of this routine is to generate data, any existing data will be replaced. For this reason, you should begin with an empty output spreadsheet.**

In this example, we will show you how to generate a six-factor design using sixteen runs separated in blocks of four runs each.

Setup

If the procedure window is not already open, use the PASS Home window to open it. The parameters for this example are listed below and are stored in the **Example 1** settings file. To load these settings to the procedure window, click **Open Example Settings File** in the Help Center or File menu.

Design Tab	
Runs	**16**
Block Size	**4**
Sort Order	**Standard**
Factor 1	**-1 1**
Factor 2	**-1 1**
Factor 3	**-1 1**
Factor 4	**-1 1**
Factor 5	**-1 1**
Factor 6	**-1 1**
Store Data on Spreadsheet	**Checked**
Block Column	**1**
First Factor Column	**2**

Output

Click the Calculate button to perform the calculations and generate the following output.

Design Information Section

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Design:
1/4 replication of 6 factors in 4 blocks of 4 experiments.

Defining Contrast:
i = ABCE = BCDF = ADEF

Design Construction:
Generate a reduced model of the factors [A B C D].
The remaining factors are aliased with interactions of this reduced model as follows:
E = ABC
F = BCD

Blocking Section

Block:
Blocks were generated by confounding them with the following interactions from the reduced model:
ABCD, CD

This report provides technical information about the design that was generated.

Aliases Section

One-Factor Aliases Section

A+BCE+ABCDF+DEF
B+ACE+CDF+ABDEF
C+ABE+BDF+ACDEF
D+ABCDE+BCF+AEF
E+ABC+BCDEF+ADF
F+ABCEF+BCD+ADE

Two-Factor Interaction Aliases Section

AB+CE+ACDF+BDEF
AC+BE+ABDF+CDEF
AD+BCDE+ABCF+EF
AE+BC+ABCDEF+DF
AF+BCEF+ABCD+DE
BC+AE+DF+ABCDEF
BD+ACDE+CF+ABEF
BE+AC+CDEF+ABDF
BF+ACEF+CD+ABDE
CD+ABDE+BF+ACEF
CE+AB+BDEF+ACDF
CF+ABEF+BD+ACDE
DE+ABCD+BCEF+AF
DF+ABCDEF+BC+AE
EF+ABCF+BCDE+AD

This report lists the aliases of the main effects and low-order interactions. The number of aliases listed is controlled by the Aliases Shown option.

From the first line of the report, we find that factor A (factor 1) is confounded with interactions BCE, DEF, and ABCDF. If any of the three-factor interactions are known to be real, this design would not be useful. Note that no two-factor interactions (like AB or CD) are aliased with the main effects.

1/4 Rep of a Six-Factor Design in Blocks of 4 Runs

Experimental Design

Row	Block	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
1	1	-1	-1	-1	-1	-1	-1
2	1	1	1	-1	-1	-1	1
3	1	-1	-1	1	1	1	-1
4	1	1	1	1	1	1	1
5	2	1	-1	-1	-1	1	-1
6	2	-1	1	-1	-1	1	1
7	2	1	-1	1	1	-1	-1
8	2	-1	1	1	1	-1	1
9	3	1	-1	1	-1	-1	1
10	3	-1	1	1	-1	-1	-1
11	3	1	-1	-1	1	1	1
12	3	-1	1	-1	1	1	-1
13	4	-1	-1	1	-1	1	1
14	4	1	1	1	-1	1	-1
15	4	-1	-1	-1	1	-1	1
16	4	1	1	-1	1	-1	-1

The block and factor values were also produced on the spreadsheet.

These values are also generated on the spreadsheet.