Chapter 261

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.

When generating a design, the program first checks to see if the design is among those listed on page 410 of Box and Hunter (1978). These designs are especially good. 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 program makes certain that main effects are not aliased with each other.

An introduction to experimental design is presented in the Two-Level Factorial Designs documentation chapter 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.

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

CAUTION: since the purpose of this procedure is to generate data, any existing data will be replaced. For this reason, you should begin with an empty dataset.

Setup

To run this example, complete the following steps:

1 Specify the Fractional Factorial Designs procedure options

- Find and open the **Fractional Factorial Designs** procedure using the menus or the Procedure Navigator.
- The settings 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	**Random**
Random Seed	**4983726** (for Reproducibility)
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 the Design Data in the Data Table	**Checked**

2 Run the procedure

- Click the **Run** button to perform the calculations and generate the output.

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

Block	Factor_1	Factor_2	Factor_3	Factor_4	Factor_5	Factor_6
1	1	-1	-1	1	1	1
1	1	-1	1	-1	-1	1
1	-1	1	1	-1	-1	-1
1	-1	1	-1	1	1	-1
2	-1	-1	-1	1	-1	1
2	1	1	-1	1	-1	-1
2	-1	-1	1	-1	1	1
2	1	1	1	-1	1	-1
3	1	-1	-1	-1	1	-1
3	-1	1	-1	-1	1	1
3	1	-1	1	1	-1	-1
3	-1	1	1	1	-1	1
4	-1	-1	1	1	1	-1
4	1	1	1	1	1	1
4	1	1	-1	-1	-1	1
4	-1	-1	-1	-1	-1	-1

Notice that Block contains the four block indices, and columns Factor_1 through Factor_6 contain the generated design values.

If you used a random seed, your data may not appear in the same order as this example.

You would now proceed with your experiment, obtain the response values, and analyze the data using one of the analysis of variance programs or the Two-Level Design - Analysis program.

Design Information

Design Information

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

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

One-Factor Aliases

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

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

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.