The Supplementary Files for "A Note on Dominating Fractional Factorial 2-Level Designs With Clear Two-Factor Interactions"

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This archive includes

- a pdf file with Table 1 of the note for reference
- two text files with programs used for identifying dominating designs
- a pdf-file with instructions for obtaining the development version of R package igraph that contains the LAD algorithm
- and two text files with the generators of the dominating designs that have been identified.

This Readme document describes these files and explains how the identification of dominating designs was conducted.

1. PROGRAMS AND SEARCH PROCESS

The search was conducted within R software under Windows, using the design catalogues available in packages **FrF2** (Grömping 2013a) and **FrF2.catlg128** (Grömping 2013b), a modified function from package **FrF2** (supplemental file **`mapcalc.lad_pre.R`** includes function **`mapcalc.lad`**, which is a modified version of the internal function **`mapcalc`** of package **FrF2**), and function **`subgraph.isomorphic.lad`** from an early build of the unreleased version 7 of R package **igraph** (Csardi and Nepusz 2006), which was kindly provided by Gabor Csardi. The call to function **`mapcalc.lad`** is conducted from catalog-specific search programs (see below). Options of function **`mapcalc.lad`** are as documented for function **`mapcalc`**, except for the additional option "**`method`**" that allows to choose the LAD algorithm. Once subgraph isomorphism search with the LAD algorithm will be available in the official release of package **igraph** on the Comprehensive R Archive Network CRAN, a final version of function **`mapcalc.lad`** will replace the current function **`mapcalc`** of

package **FrF2**. Readers who want to run the code themselves before the LAD algorithm is part of the official release of R package **igraph** find instructions on obtaining a development version in a separate text file in these supplementary materials.

Function **`mapcalc.lad`** searches within a catalogue of clear interactions graphs (CIGs) whether a given requirement set CIG is isomorphic to a subgraph of a catalogued design's CIG. The file **`vectorMAadmiss_example.R`** contains a sample program for looping through one of the catalogues in pursuit of identifying all dominating designs. The result is a logical vector that is TRUE for dominating designs, FALSE for other designs and has subsequently been integrated into each respective catalogue. The search approach was as follows: As the catalogues are sorted from best to worst in terms of aberration (arbitrary order in case of ties), each design can be declared dominating if its CIG is not isomorphic to a subgraph of any design that occurs earlier in the catalogue. A technical detail is included here for the sake of transparency (although not considered relevant): Failure to accommodate a design's CIG as a subgraph was detected through capturing an error; when originally running the program, some designs with one clear 2fi only were wrongly declared dominating because of a different type of error caused by a formatting issue of the element **`clear.2fis`** of the catalogue entries for designs with one clear 2fi (vector instead of one-column matrix). This formatting issue has been fixed in the mean time, and the wrong classifications have been corrected post-hoc.

2. THE DOMINATING DESIGNS

The dominating designs have been identified from searching catalogues of non-isomorphic designs, sorted by aberration from best to worst; for up to 64 runs, a complete catalogue was searched, whereas for 128 runs, the search was restricted to even/odd designs, which is sufficient as was proven by Wu, Mee and Tang (2012). The catalogues on which the search was based are part of the R packages **FrF2** (up to 64 runs; Grömping 2013a) or **FrF2.catlg128** (128 runs; Grömping 2013b); within these packages, they are provided with pre-calculated CIGs (element **`clear.2fis`** of each catalogue entry, a two-row matrix with a column for each edge). They originate from Chen, Sun and Wu (1993; for 64 runs, the complete catalogue has been provided by Don Sun in a personal communication), Xu (2009, the 128 run designs with up to 25 factors) or Mee (2012, the 128 run designs with 26 to 33 factors).

Relevant resolution IV dominating designs exist and have been evaluated

- for 32 runs with up to 9 factors (the overall MA design only, except for the 9 factor situation, for which the second best MA design is also dominating)
- for 64 runs with up to 17 factors (see supplementary file **`64run-dominating.txt`**)
- for 128 runs with up to 33 factors (see supplementary file **`128run-dominating.txt`**)

Resolution IV dominating designs do not exist for smaller setups and have not been evaluated for larger situations.

The two text files with dominating designs are structured as follows: a line with the number of factors is followed by a separate line for each dominating design in this number of factors, showing (separated by colons)

- the design name (e.g., 15-9.3 for the dominating design in 21^{15-9}=64 runs and 15 factors; this design ranks 3rd in the list of all non-isomorphic designs),
- the word length pattern (A_4 to A_6; e.g., 33 44 96 for the above design)
- and the generating columns (Yates matrix column numbers in addition to the powers of 2; the number of columns needed is of course a consequence of the numbers of factors and runs, e.g. 9 columns for the above design)

The pdf file with Table 1 provides the context from the manuscript for easy reference; especially, it clarifies how many designs there are for each combination of number of runs with number of factors.

3. REFERENCES

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