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Locating and detecting arrays for interaction faults. (English)

Summary: The identification of interaction faults in component-based systems has focused on indicating
the presence of faults, rather than their location and magnitude. While this is a valuable step in screening
a system for interaction faults prior to its release, it provides little information to assist in the correction
of such faults. Consequently tests to reveal the location of interaction faults are of interest. The problem of
nonadaptive location of interaction faults is formalized under the hypothesis that the system contains (at
most) some number d of faults, each involving (at most) some number t of interacting factors. Restrictions
on the number and size of the putative faults lead to numerous variants of the basic problem. The
relationships between this class of problems and interaction testing using covering arrays to indicate the
presence of faults, designed experiments to measure and model faults, and combinatorial group testing to
locate faults in a more general testing scenario, are all examined. While each has some definite similarities
with the fault location problems for component-based systems, each has some striking differences as well.
In this paper, we formulate the combinatorial problems for locating and detecting arrays to undertake
interaction fault location. Necessary conditions for existence are established, and using a close connection
to covering arrays, asymptotic bounds on the size of minimal locating and detecting arrays are established.

MSC:
90B80 Discrete location and assignment
90C27 Combinatorial optimization

Keywords:
Covering array; Orthogonal array; Factorial design; Cover-free family; Disjunct matrix; Locating array;
Defecting array

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