STANFORD UNIVERSITY

DEPARTMENT OF STATISTICS

DEPARTMENTAL SEMINAR

4:15 p.m., Tuesday, April 22, 2003
Sequoia Hall Room 200
(Cookies at 3:45 in 1st Floor Lounge)

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Designing Experiments for Causal Networks

Causal networks are directed graphs representing cause-effect relationships and are multiple-response generalizations of Ishikawa's cause-effect diagrams. Emphasizing tolerance design applications, I describe an algorithm for designing suitable experiments when the factors and responses are organized in a causal network. The causal network is transformed into a so-called causal map, which represents all factors and responses as points in a common D-dimensional metric space. The design approach is algorithmic, optimizing the entropy criterion due to Wynn. This criterion is applied to maximize dispersion among the multiple responses, using a distance-in-space coefficients model. A key constraint is for the blocks to be self- contained; this implies that each block can be analyzed without reference to other blocks. This is to be complemented by a unified, all-block analysis. The resulting designs are evaluated for efficiency, response dispersion, and resolution V column rank. Particular attention is given to skewing each block by shifting one or a few factors off-center.

Key Words: blocking, cause-effect diagram, directed graph, multidimensional scaling, optimal design, tolerance design.