

Abstract

Group Testing as Coding over the binary semifield via Residuation Theory

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We present a novel approach to (non-adaptive) group testing by describing it in terms of residuated pairs on partially ordered sets. The resulting efficient decision scheme covers large classes of group testing schemes for pandemic diseases during the initial low prevalence phase.

Our design of the testing schemes is based on incidence matrices of finite (partial) linear spaces. The results may be tailored for different estimated disease prevalence levels. The key idea is that by building sufficient structure into the test-design matrix, one may increase what may be called the efficiency of the testing.

We also observe that generalized quadrangles are of significant advantage in comparison with other types of block designs. For simplicity, we state our results when the tests are error-free. An adaptation to a low error-rate scenario is actually beyond the scope of this work but will be briefly discussed in a final section.

Joint work with Cornelia Roessing.