Adaptive Designs
IMS Lecture Notes - Monograph Series (1995) Volume 25

NEW PROCEDURES FOR GROUP-TESTING BASED ON THE HUFFMAN LOWER BOUND AND SHANNON ENTROPY CRITERIA

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Abstract

Our goal is to devise an efficient, possibly optimal method for identifying all defective units or determining that there aren't any among N given units. To do this, we use adaptive group-testing methodology assuming a binomial random sample of N independent and identically distributed units with known probability q of each unit being good. The optimality desired is to minimize the expected number of tests required. But this optimality may be infeasible. Two procedures (R_{HLB} and R_{1A}) for the group-testing problem are studied. Procedure R_{HLB} is based on the Huffman lower bound and Shannon-entropy criteria. All of the algorithms introduced have low design complexity and yet provide near-optimal results. Both procedures are adaptive in the sense that the present test can depend on the results of any or all previous tests. For $N = 5$, one of the procedures introduced can be shown to be optimal for selected values of q. It is conjectured that this procedure is optimal for all values of q. It is conjectured that this procedure is optimal for all values of q and $N > 5$.

Received March 1993; revised July 1994.
AMS 1991 subject classifications. Primary 62N10.
Key words and phrases. Adaptive group testing, binomial set, contaminate set, expected group-test number.