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FLEXIBLE ALGORITHMS FOR CREATING AND ANALYZING ADAPTIVE SAMPLING PROCEDURES

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We describe a collection of algorithms and techniques that have been developed to aid in the design and analysis of adaptive allocation procedures. The emphasis is on providing flexibility to the investigator, so that appropriate statistical and practical concerns can be addressed directly. The techniques described allow for optimizations previously not attainable. They also permit exact evaluations for a wide range of criteria and are intended to encourage investigators to explore more alternatives. Optimizations investigated include 2- and 3-population fully sequential models, few-stage models, and models with constrained switching between options. One of our algorithmic approaches, path induction, speeds up the process of evaluating a procedure multiple times so that thorough robustness studies can be undertaken. Our approaches can be utilized with both Bayesian and frequentist analyses.

1. Introduction. In situations where data are collected over time, adaptive sampling methods often lead to more efficient results than do fixed sampling techniques. When sampling or "allocating" adaptively, sampling decisions are based on accruing data. In contrast, when using fixed sampling procedures, the sample sizes taken from different populations are specified in advance and are not subject to change. Using adaptive techniques can reduce costs, time and improve the precision of the results for a given sample size. Fully sequential adaptive procedures, in which one adjusts after each observation, are the most powerful. Such procedures are rarely used, however, due to difficulties related to generating and implementing good procedures as well as to complications associated with analyzing the resulting data.

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