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

EXACT COMPUTATIONAL ANALYSES FOR ADAPTIVE DESIGNS

BY JANIS P. HARDWICK[1] AND QUENTIN F. STOUT[2]

The University of Michigan

Abstract

We show how to compute optimal designs and exact analyses of allocation rules for various sequential allocation problems. The problems we have solved include parameter estimation in an industrial scenario and testing in a clinical trial. Our computational approach incorporates backward induction, dynamic programming, and a new technique of forward induction. By utilizing efficient algorithms and careful implementation, we are able to determine exact solutions to practical problems previously approached only through simulation or approximation.

1. Introduction. We discuss the exact analyses of sequential allocation rules for a variety of applications. Our interests include both estimation and testing problems, and we have examined allocation rules for selected applications in medicine and industry. In the former, we study the design and evaluation of optimal allocation rules for clinical trials with ethical costs [see Hardwick and Stout (1991, 1993b) or

Received January 1993; revised April 1993.

[1]Research supported in part by the National Science Foundation under grants DMS-8914328 and DMS-9157715.

[2]Research supported in part by the National Science Foundation/DARPA under grant CCR-9004727.

AMS 1991 subject classification. Primary 62L05; secondary 62K05, 62N05, 62A15, 62L10.

Key words and phrases. Backward induction, Bayesian design, clinical trials, constrained dynamic programming, forward induction, multiple criteria.