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Automatic Generation of Combinatorial Test Data

Springer

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Foreword

When software is designed using a large number of components, and is then executed in an environment that itself contains a large number of components, faults often arise from unexpected interactions among the components. How can we test these complex systems of interacting components? In particular, how can we find test suites that can reveal the most likely faults? The combinatorial explosion in the number of possible tests must be avoided; in principle, it can be avoided if faults arise from interactions among a few components. Yet generating small test suites remains a very challenging problem.

Some research concentrates on the underlying combinatorial problems and neglects the needs of the software tester; other research addresses testing without exploiting combinatorial information effectively. This book is valuable because it encompasses both the combinatorial theory and the testing practice. It formulates the construction of test suites as a combinatorial problem, clearly explaining the connection with testing needs. After introducing important relationships with studies in combinatorics, it focusses on algorithmic methods for the construction of test suites. The blending of software design, algorithms, and combinatorial mathematics provides an excellent introduction to this important topic.

Phoenix, AZ, USA, June 2014 Charles J. Colbourn

Preface

Testing is an important part of the software development life cycle. Many testing techniques have been proposed and used, to increase the quality and reliability of software and systems. Among them, combinatorial testing is a kind of black-box testing method that is gaining increasing popularity. It is particularly useful to reveal faults that are caused by the interaction of a few components/parameters of the system.

For many kinds of testing techniques, a challenging problem is to generate a small set of test cases which achieves certain coverage criterion. This is also true for combinatorial testing. Over the past 30 years or so, many different kinds of algorithms have been proposed. Some of them were designed specifically to solve the problem, while others are based on ideas from evolutionary computation and constraint processing communities.

This book intends to review the state of the art of automatic data generation methods for combinatorial testing. The first chapter introduces the basic concepts and notations that will be used later. It also gives a brief overview of the applications of combinatorial testing. The next five chapters describe various kinds of methods for generating input data for combinatorial testing. Each of these chapters can be read almost independently. Chapter 7 gives a list of tools that can be readily used. In the last chapter, we briefly discuss several other problems that are closely related to test data generation.

The book can be read by graduate students and researchers who work in the area of combinatorial testing (or testing in general). It should also be interesting to those who work in discrete mathematics, constraint solving, evolutionary computation, and other related fields. Practitioners may find the book useful when selecting a suitable technique and tool.

Due to the limit on the size of the book, we could not explain every algorithm in detail. We may also miss some important works in this field. You are welcome to contact us if you have any comments and suggestions.

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