

Generalized Algorithmic Debugging and Testing

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This paper presents a method for semi-automatic bug localization, generalized algorithmic debugging, which has been integrated with the category partition method for functional testing. In this way the efficiency of the algorithmic debugging method for bug localization can be improved by using test specifications and test results. The long-range goal of this work is a semi-automatic debugging and testing system which can be used during large-scale program development of nontrivial programs.

The method is generally applicable to procedural languages and is not dependent on any ad hoc assumptions regarding the subject program. The original form of algorithmic debugging, introduced by Shapiro, was however limited to small Prolog programs without side-effects, but has later been generalized to concurrent logic programming languages. Another drawback of the original method is the large number of interactions with the user during bug localization.

To our knowledge, this is the first method which uses category partition testing to improve the bug localization properties of algorithmic debugging. The method can avoid irrelevant questions to the programmer by categorizing input parameters and then match these against test cases in the test database. Additionally, we use program slicing, a data flow analysis technique, to dynamically compute which parts of the program are relevant for the search, thus further improving bug localization.

We believe that this is the first generalization of algorithmic debugging for programs with side-effects written in imperative languages such as Pascal. These improvements together makes it more feasible to debug larger programs. However, additional improvements are needed to make it handle pointer-related side-effects and concurrent Pascal programs.

A prototype generalized algorithmic debugger for a Pascal subset without pointer side-effects and a test case generator for application programs in Pascal, C, dBase, and LOTUS have been implemented.

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Additional Key Words and Phrases: Algorithmic debugging, automated debugging, category partition testing, program slicing

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Table of Contents Generalized Algorithmic Debugging

1. Understanding the eBook Generalized Algorithmic Debugging
 - The Rise of Digital Reading Generalized Algorithmic Debugging
 - Advantages of eBooks Over Traditional Books
2. Identifying Generalized Algorithmic Debugging
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Generalized Algorithmic Debugging
 - User-Friendly Interface
4. Exploring eBook Recommendations from Generalized Algorithmic Debugging
 - Personalized Recommendations
 - Generalized Algorithmic Debugging User Reviews and Ratings
 - Generalized Algorithmic Debugging and Bestseller Lists
5. Accessing Generalized Algorithmic Debugging Free and Paid eBooks

- Generalized Algorithmic Debugging Public Domain eBooks
 - Generalized Algorithmic Debugging eBook Subscription Services
 - Generalized Algorithmic Debugging Budget-Friendly Options
6. Navigating Generalized Algorithmic Debugging eBook Formats
 - ePub, PDF, MOBI, and More
 - Generalized Algorithmic Debugging Compatibility with Devices
 - Generalized Algorithmic Debugging Enhanced eBook Features
 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Generalized Algorithmic Debugging
 - Highlighting and Note-Taking Generalized Algorithmic Debugging
 - Interactive Elements Generalized Algorithmic Debugging
 8. Staying Engaged with Generalized Algorithmic Debugging
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Generalized Algorithmic Debugging
 9. Balancing eBooks and Physical Books Generalized Algorithmic Debugging
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Generalized Algorithmic Debugging
 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
 11. Cultivating a Reading Routine Generalized Algorithmic Debugging
 - Setting Reading Goals Generalized Algorithmic Debugging
 - Carving Out Dedicated Reading Time
 12. Sourcing Reliable Information of Generalized Algorithmic Debugging
 - Fact-Checking eBook Content of Generalized Algorithmic Debugging
 - Distinguishing Credible Sources
 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development

- Exploring Educational eBooks
14. Embracing eBook Trends
- Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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