Tribhuvan University
Institute of Science and Technology

Automatic Generation of Basis Set of Paths for White Box Unit Testing

Dissertation

Submitted to

Central Department of Computer Science and Information Technology
Kirtipur, Kathmandu, Nepal

In partial fulfillment of the requirements
for the Master's Degree in Computer Science and Information Technology

By

Suraj Karki

May, 2010

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I hereby recommend that the dissertation prepared under my supervision by **Mr. Suraj Karki** entitled **"Automatic Generation of Basis Set of Paths for White Box Unit Testing"** be accepted as fulfilling in partial requirements for the degree of M.Sc. in Computer Science and Information Technology.

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LETTER OF APPROVAL

We certify that we have read this dissertation work and in our opinion it is satisfactory in the scope and quality as a dissertation in the partial fulfillment for the requirement of Master of Science in Computer Science and Information Technology.

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Student's Declaration

I hereby declare that I am the only author of this work and that no sources other than the listed here have been used in this work.

… … … … … … …
Suraj Karki
Date: May, 2010

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ABSTRACT

Software testing is defined as the process of executing the program with the intent of finding an error that ensures the correctness, completeness and quality of the developed software. Black-box and white-box testing are the two major techniques for software testing. In black-box testing, no information about the internal structure of the program under testing is available. However, in white-box testing, a complete source code or the internal structure is available.

Unit testing of conventional or object-oriented software makes heavy use of white-box testing techniques, specifically basis path testing. Basis path testing is a white-box testing technique that uses a Control Flow Graph (CFG) of a program under test to generate a basis set of independent paths .Different techniques have been proposed in this thesis to generate basis set of independent paths.

In this thesis, we implemented an algorithm to develop a software tool that performs the following three tasks:

- Constructs a control flow graph of a given program based on the pseudocode.
- Computes the cyclomatic complexity of the control flow graph.
- Generates a basis set of independent paths of the control flow graph.

Experiments on our tool show that the algorithms implemented for control flow graph construction, computation of cyclomatic complexity and generation of basis set of independent paths for a program under test gives acceptable results and yield results in a reasonable time. It has been observed that the algorithm implemented in our program generates a basis set of paths for a given control flow graph in O (max (n, e)) time complexity where n is the number of nodes and e is the number of edges in the control flow graph.

Table of Contents

Details	Page No
Acknowledgements	i
Abstract	ii
Tables of Contents	iii
List of Figures	vi
List of Tables	vii
Abbreviations	viii
CHAPTER 1	**1-5**
1. INTRODUCTION	1
1.1 Software Testing	1
1.2 Testing Objectives	2
1.3 Testing Principles	3
1.4 Justification for Research	4
1.5 Research Goal	5
1.6 Organization of Thesis	5
CHAPTER 2	**6-17**
1.1. **LITERATURE SURVEY ON SOFTWARE TESTING**	6
1.2. Conventional Software Testing	6
1.3. Object Oriented Software Testing	6
1.4. Software Testing Techniques	9
1.4.1. Static Testing	9
2.3.1.1 Code Inspections	10
2.3.1.2 Code Walkthroughs	10
2.3.1.3 Desk Checking	10
2.3.1.4 Code Reviews	11
1.4.2. Dynamic Testing	11

2.3.2.1 Black Box Testing 11
i) Equivalence Partitioning 12
ii) Boundary Value Analysis 12
iii) Graph-Based Testing Method 12
iv) Cause-and-Effect Graphing 12
v) Error Guessing 12

2.3.2.2 White Box Testing 13
i) Control Flow Testing 14
ii) Data Flow Testing 15
iii) Loop Testing 16
iv) Mutation Testing 16

CHAPTER 3 **18-41**

1.5. **RESEARCH METHODOLOGY** 18
Drawing Control Flow Graph 18
3.1.1 Importance of Control Flow Graph 20
3.1.2 Example of Control Flow Graph 21
3.1.3 Matrix Representation of Control Flow Graph 23

1.6. Determining Cyclomatic Complexity 24
3.2.1 Data Structure to Compute the Cyclomatic Complexity 26
3.2.2 Relationship between Cyclomatic Complexity and Testing 28
3.3. Determining a Basis set of Linearly Independent Paths 29
3.3.1 Methods to Generate the Basis set of Paths 30
3.3.1.1 Joseph Poole Approach 31
3.3.1.2 Bhattacherjee et al. Approach 32
3.3.1.3 Guangmei et al. Approach 36
3.3.1.4 Salloum and Salloum Approach 37
3.3.1.5 Baseline Method 40

CHAPTER 4 **42-50**

2. IMPLEMENTATION 42

2.1. Pseudocode of the Program 42
2.2. Program Facts 47
4.2.1 Control Flow Graph 47
4.2.2 Syntax Errors 48
4.2.3 Semantic Errors 48
4.2.4 Data Structure 48
4.2.5 Programming Language 49
4.2.6 Display 49
4.2.7 Program Assumptions 50

CHAPTER 5 51-65

3. EXPERIMENTS,RESULTS AND EVALUATION 51
3.1. Experiments Design 51
3.2. Experimental Results 51
5.2.1 Compare 51
5.2.2 Sum of Squares 52
5.2.3 Binary Search 53
5.2.4 Bubble Sort 55
5.2.5 Selection Sort 57
5.2.6 Quick Sort's Partition Algorithm 59
5.2.7 Insertion Sort 61
5.3 Evaluation of Results 65

CHAPTER 6 66-67

3.3. **CONCLUSION AND FURTHER RECOMMENDATION** 66
3.4. Conclusion 66
3.5. Further Recommendation 67

References 68-71

List of Tables

Details	Page No.
Table 1.1 : Graph matrix to compute the cyclomatic complexity	27

List of Figures

Details	Page No.
Figure 1.1 : A block diagram of the software testing process	2
Figure 3.1 : Control flow graph notations	20
Figure 3.2 : Pseudocode for finding greatest common divisor	21
Figure 3.3`: Control flow graph of pseudocode in figure 3.2	22
Figure 3.4 : Labelled control flow graphs of different programming constructs	23
Figure 3.5 : A control flow graph to illustrate Joseph approach to generate the basis set of paths	32
Figure 3.6 : An example graph to illustrate the Symmetric Algorithm	34
Figure 3.7: A control flow graph to illustrate the Salloum and Salloum algorithm	38
Figure 3.8: A tree representing a basis set of paths generated by the algorithm for the CFG of figure 3.7	38

List of Abbreviations

BBT	Black Box Testing
CASE	Computer Assisted Software Engineering
CC	Cyclomatic Complexity
CFG	Control Flow Graph
DFS	Depth First Search
OO	Object Oriented
SUT	Software Under Test
WBT	White Box Testing