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**Title** : Automatic Test Data Generation for Data-  
Flow Testing Using Nature Inspired  
Evolutionary Meta-Heuristics Genetic  
Algorithm

## **ABSTRACT**

Software Testing is a process of executing a program with the intent of finding errors. There are some different kinds of the Software Testing approaches which are applied in software industries. Some of the important testing are unit testing, integration testing, system and function testing, acceptance testing. Unit testing concentrates on each unit (Module) of the software as implemented in the source code. Integration testing is putting the modules together and construction of software architecture. System and Functional Testing are those in which product is validated with other system elements and tested as a whole. Tester collects the feedback of the software from the user through acceptance testing. Besides these Software Testing, there is also a load testing, which is applied on web application when they run on some servers and the application is checked under anticipated user load. The main aim of this testing is to test all the bottlenecks before delivering the software to the customer.

Software Testing can be done by manual process or automatic testing. The manual testing process is so much time taking and costly process. Automatic testing is a good idea to reduce time and cost. In automatic testing, we have to take a set of inputs and then these inputs are applied to some tools for automatic testing and finally desired output is found. Now the main questions arises here are, how many test cases we have to take, what test cases are useful and finally how can we conclude that these test

cases are sufficient to test the program/software. So the generation of the automatic test cases are not easy and it is a problem of NP-Hard.

In recent years nature inspired algorithms are so much popular in computer science research areas. These nature inspired algorithms are applied for optimizing the process of automatic test case generation. For example, Genetic Algorithm (GA), Ant Colony Optimization (ACO), Swam Partition Optimization (SPO), Cuckoo Search Optimization (CSO), etc. but still, the scope of research in automatic test generation remains a challenge.

In our research, we have proposed and developed some methods through a different kind of testing process to generate test cases automatically. For generating and optimizing test cases automatically, first, we developed a tool in C# for generating Control Flow Graph (CFG) for a given program. This tool will also calculate cyclomatic complexity of the program and using this cyclomatic complexity we will be able to find how many paths in a given program should be traversed. With the use of this tool, we developed different methods for automatic test case generation using genetic algorithm. All def-use plays a significant role in path coverage of path testing. Mutation-based testing is also used with the genetic algorithm for automatic test case generation. Different selection and fitness functions of the genetic algorithm are used here for automatic test cases generation. There is also one different nature-inspired optimization technique, cuckoo search optimization which is also used for optimization of automatic test cases.