

**SOME TECHNIQUES FOR THE ASSESSMENT AND
IMPROVEMENT OF TESTABILITY FOR THE OBJECT
ORIENTED SOFTWARE**

By

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CERTIFICATE

This is to certify that the work embodied in the thesis titled “**SOME TECHNIQUES FOR THE ASSESSMENT AND IMPROVEMENT OF TESTABILITY FOR THE OBJECT ORIENTED SOFTWARE**” has been completed by Anju Saha under the guidance of Prof. Yogesh Singh towards fulfillment of the requirements for the degree of Doctor of Philosophy of Guru Gobind Singh Indraprastha University, Delhi. This work is based on original research and has not been submitted in full or in part for any other diploma or degree of any university.

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Abstract

With the increasing emphasis on object oriented paradigm, a number of object oriented testing techniques have been developed to test the object oriented software. Some of these techniques are just an adaptation of the conventional testing techniques to the object oriented software and some are true object oriented testing techniques. Testing can be made more effective and less difficult if the testability of the software is increased. The purpose of this work is twofold: 1) to develop new object oriented testing techniques and 2) to assess the class testability in order to ease the testing.

A number of object oriented testing techniques are available in literature to test the object oriented software. We have done an extensive survey of these testing techniques in order to provide the issues in object oriented testing and describe briefly most of the testing techniques developed at different levels (unit level, integration level, and system level). Two object oriented testing techniques are proposed based on the concept of design by contract. One of the techniques is based on the data flow testing and another is a state based testing technique. Design by contract is a methodology to improve the testability of the software. Hence, the techniques developed help in improving the testability of the software. These techniques are validated through a number of programs. An extensive survey of testability research is done in the object oriented software and the conventional software. A study is performed at the class level to assess the testability of four large open source java systems. The testability is assessed through the testing effort which is calculated from the JUnit based test classes in

the java software. An Eclipse plugin is used to extract the values of design metrics and test metrics from the source code of java software which is used for the study. A correlation is found between the testing effort and fourteen design metrics (the design metrics are based on size, cohesion, coupling, inheritance, and polymorphism) of the java classes. A high correlation is found between most of the design metrics and test metrics which showed that the testing effort and hence the testability can be assessed through the design metrics. The testability of Eclipse (probably one of the biggest open source project) is assessed at the package level using the same methodology as done at the class level. The data collected from large java systems are used to construct the prediction models using the statistical approaches and the neural networks to predict testability of the object oriented software. The aim is to compare the results of the neural network methods to the statistical approaches for predicting the testability of the object oriented software.