

Test Cases Prioritization Using Model Based Test Dependencies: A survey

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Abstract

Software Testing is a part of software engineering which helps to identify failure or defect in advance to give quality to the product. Regression testing is an important aspect of testing field in which modified part of the software will be tested to ensure that no new errors will be generated into previously tested code. Regression test suite is typically large so that a method or technique should select for test cases which will give effectiveness to the software and also reduces the overall cost. In this kind of situation test case prioritization technique is used to give the effectiveness to the software. It organizes test cases in an order such that, test case having high priority will be executed first through which effectiveness will be increases. Performance goal of test case prioritization is fault detection; number of faults will be detected quickly during testing process, code coverage and reliability.

Keywords- Regression Testing, Test Case, Test Case Prioritization, APFD (Average Percentage Fault Detection)

1. Introduction

Software testing is performed to verify that software is build according to the customer specification or requirements. It will increase the quality and efficiency of the software [1]. The overall objective of testing is to find out bug in the software by applying different kind of testing(unit testing, load testing performance testing,

regression testing, smoke testing, stress testing, black box testing ,white box testing etc) to uncover the faults as soon as

possible to give effectiveness to the software. When software is modified or enhances after fixing some error, Regression Testing reruns the regression testing suite to ensure that new version of software project runs smoothly and correctly [2].

Regression test suite is typically large, for performing testing on test suite various techniques should be applied to reduce the overall cost and time. The various techniques are:-

- a) Retest All
- b) Test Case Selection
- c) Test Case Prioritization
- d)Test Case Reduction
- e) Hybrid Approach

a)Retest All:- All the test cases in the existing test suite will be executed again. This technique is very expensive and required lot of time for re-execution of test cases[4][11].

b)Test Case Selection:-Instead of re-running the whole test suite a part of test suite will be selected to give the maximum number of faults[4]. It divides the test suite in 3 parts:- (1) Reusable Test Case, (2) Retest able Test Case,(3) Obsolete Test case. The drawback of this technique is that it does not give the effectiveness of the software while using lot of resource and it will permanently remove the test cases from test suite. Sometimes discarded test cases will give maximum no of faults.

c)Test Case Prioritization:- In this technique the test cases will be prioritized to give maximum number of faults[6][7][9]. The main goal of prioritization is to give the effectiveness to the software by detecting faults, by increasing confidence in reliability and also in code coverage property. It has an advantage over selection technique that is does not eliminate the test cases from the test suite permanently. Fault detection rate is high by assigning the priority to the test cases to give the effectiveness of the software by doing maximum code coverage.

d)Test Case Reduction:-The purpose of this technique is to eliminate redundant test cases from the test suite to save the cost of regression testing[8]. It also minimizes the total running time of the remaining test cases. The drawback of reduction technique is that the fault detection effectiveness of test suites can be severely decreased by reduction.

e) Hybrid Approach:-It is combination of test case selection and test case prioritization.

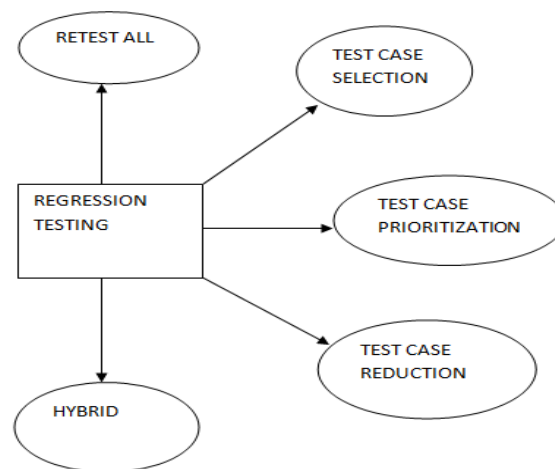


Fig 1: Test Cases Prioritization Techniques

2. Literature Review

Shifa-e-Zehra et al [19] conducted study on prioritization using dependencies. According to them Prioritization technique using dependency structure is very efficient when there exists large coupling. As dependencies can be observed and based on those dependencies test case prioritization is done which lead to the ordering of test cases and the test cases having more dependents will be executed first. With the help of prioritization resource can also be used efficiently. Otherwise, the test cases which are important to execute gets no resources. Dependency can be open or closed different algorithms can be used to detect both kinds of dependencies. Basically, the focus in this paper is on the test case dependencies and further prioritization of test cases according to those discovered dependencies.

Shin Yoo et al [20] has selected the papers that deals with test suite minimisation, test case selection and test case prioritisation. According to them the work on these three is strongly associated to each other. As test suite minimisation checks out for the test plans and wherever the duplicity is present there it decreases the size of test plans which leads to the test suite minimisation. With the reduction the test suites gets removed everlasting. Test case selection process selects the test cases from a typical set of test cases. And Test case prioritisation technique provides the priorities to the different test cases, further these test cases will be run in the order of their priority. The test case with higher priority will run first and the test case with lowest priority will run at the last.

Swarnendu Biswas et al [21] describes about the test suite management as: Test suits needed to be managed as when the modification are made in the original test suites in order to provide more functionality, some new test cases needed to put in while some of the test cases needed to get out of the suite, this in and out process needs management. Test cases reuse is the process of using again those test cases that have previously been used before the modifications. We can use them again in order to reduce the efforts and money.

Prateeva Mahali et al [22] provides model based optimization and prioritization for the test suites in regression testing. According to their methodology the optimization of test cases is performed using genetic algorithm after that prioritization is performed in order to produce better results and the successful regression testing. They found deduction in cost and time with the current methods. They have taken a case study of a shopping mall which is providing better results as comparison. The system which is under test has been represented with UML 2.0 activity diagram.

Quart-ul-an-farooq et al [23] presented a state based regression testing approach. The tool used for the approach is START which is an eclipse based. START treats the dependencies that exist between the various states. When the modifications will take place the dependencies must be taken care and this can be possible through start. START takes UML 2.1 class diagrams and state machines. For proving the efficiency of the technique a case study has been depicted which is “student enrolment system”. It shows the reduction of test suites. START can also be incorporated with other testing tools and it absolutely works fine with them. The main parts of the START are: Parsor, Comparator and test suite analyzer. And it takes inputs in the form of XMI v2.1 format.

3. Test Case Prioritization

Test case prioritization is considered when we need test cases having higher priority to be run earlier than the other test cases present. With this approach defects can be found early. The problem of resource lacking can be resolved as resource can be better utilized. Priorities are not assigned randomly but got assigned according to some principle. And then test cases will run according to their own order of execution. If we will detect the faults former then release of the product will be before on time as well [25]. And we can detect the faults former by prioritizing test cases. The approach can used for this prioritization is discovering the “functional dependencies”. Scenarios that will be having more dependencies will produce more faults as well. Techniques can be:

Open dependency structure: it can be described as; one test case should be executed prior to other test case anywhere in the program [26].

Closed dependency structure: it can be described as; one test case should be executed just before the other test case means the other test case must follow the first test case. Need for prioritization of test cases: whenever we have inadequate number of resources then it may happen that the test cases which are not so much required to get run would consume the resources which results in lack of resources for the test cases which are urgently required to run. So to avoid this kind of condition to occur, we can prioritize the test cases. With the help of which we can give high priority to the test cases which are urgently required to run and lower priority to those test cases which are less needed to get run which will lead to better utilization of inadequate resources [26]. Test case prioritization will also decrease the time consumption and will lead to early detection of faults.

4. Model Based Testing

This is a testing technique based on models means test cases gets generated from the models itself [22]. And the models are based on the requirements and the design of the software system. With model based testing one can find the faults early as the test cases gets generated from the models and models are generated before the actual implementations, which lead to improve the quality of the development, saves times ,efforts etc.UML is used to imprison the various requirements. Models: model is an overall description of the system that how the various components are related to each other [24].

4.1. Model based testing Process

Following are the various steps in modal based Testing [23]:

1. Informal specifications or Requirements are gathered.
2. Model gets generated from those specified requirements.
3. Test suites are generated further which contains :
 - 3.1. Test sequence: The system under test is controlled by it.
 - 3.2. Test oracle: It monitors the growth of the development, after observing.
 - 3.2.1. It provides a PASS or FAIL outcome.
 - 3.2.2. If fail occurs, it shows that the system under test doesn't match with the perception of model.

Fail may occur due to:

- a) Incorrect Implementation.
- b) Incorrect model creation.
- c) Incorrect requirement specification.

5. Problem Formulation

Prioritization of test cases is the process of arranging the test cases in a logical manner. It is useful because it helps in better utilization of expensive resources like disk space. Defects can be found earlier. Also it reduces the time required to execution of whole process. Over the past few years many prioritization techniques have been produced. But prioritization using dependencies in model based testing can give better results as comparison. As we know the technique which will be able to detect defects earlier will be more powerful. Testing is very important part of the software development life cycle, so it must be performed as efficiently as one can. Various techniques have been provided by the researchers to make testing effective. As test case optimization, test case selection, test case prioritization is used to reduce the time and increase the rate of fault detection. And model based testing has also been introduced in order to detect defects earlier. Because it is believed that developer will also gets benefit by earlier detection of faults because they can fix them if they will get to know about them earlier which ultimately will reduce the cost, effort and time.

There are various techniques which can be used to prioritize test cases like:

- a) History based: In this prioritization of test cases is done by using the prior knowledge.
- b) Knowledge based: In this test cases are prioritize by extracting the knowledge from human beings.
- c) Model based: In this test cases are prioritize by taking any system model in account.

In this research work, prioritization of test cases using their dependencies in model based testing will be performed. In order to detect the defects and provide information about these defects to the developer earlier. It will also reduce the time as the faults will be detected at early phases.

6. Conclusion

Regression testing is done on the test suite by applying one of its techniques that is test case prioritization which gives maximum number of faults and also provides effectiveness to the software. In this paper, problem is formulated to discover the maximum number of defects by prioritizing the test cases using model based dependencies. In future, test cases are prioritized with model based dependencies and efficiency of technique will be evaluated with APFD matrixes

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