An Efficient Testing Method for Social Network Applications Using Pairwise Combinatorial Testing

Arun Dabas

Lecturer
Delhi Skill and Entrepreneurship University (DSEU) , Dwarka Campus, New Delhi, India
(Formerly Integrated Institute of Technology, Dwarka, New Delhi)

***Abstract*: In the software development process testing is a crucial factor which determines quality of the software during its use. There are several testing methods to test particular software. Each testing method is not suitable for all applications instead. Best software testing mechanism is to identify and eliminate utmost possible errors in a software system. There are many domains which are crucial in nature and expand exponentially with time. Continuous expansion of fast expanding systems requires rigorous testing. Social network is one such domain where specialized testing procedure needs to be identified and implemented. Combinatorial testing is one such testing method which minimizes the test cases and produces efficient results in comparison with other testing methods. To ensure error free deployment of a crucial software system multiple testing methods may be used to eliminate undetected errors.**

Keywords: Software Testing, Pairwise, Combinatorial Testing, Software Engineering, Social Network

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I. INTRODUCTION

Testing is a crucial phase in Software Development Life Cycle. The Success and Failure of Software, up to a certain extent depends upon the quality of Software Testing. During the lifecycle of Software roughly 35-50 development cost of the whole system is consumed in the testing of the software itself. The cost increases in crucial and high risk projects particularly in large projects. Even after incurring huge amount and putting large efforts, no system can be guarantee absolutely error free.

To overcome these problems different types of software testing is adopted by software testers. Different methods are being adopted and types of test cases are designed and developed to make the system error free. The cost of overall software cost increases with the number errors present in the software. To overcome this problem many testing strategies are being adopted during software development process and particularly during the testing phase. Since most of the techniques have many advantages and disadvantages. In any case it is quite difficult to test case every single combination of input data, practically to test every single possible combination is beyond possibility of testing. Because every possible combination of test cases would enhances cost and efforts exponentially. Considering all factors and problems arising out of it, controlled test cases are the best possible mechanism, which may ensure limited number of test cases with highest coverage of test case spectrum

When tests are created manually, they tend to produce tests which add little value in discovering defects. For better management, we need to identify the tests which may identify the defects with minimum number of test cases and maximum coverage.

Combinatorial Testing is one such approach, in which we reduce the number of test cases drastically with maximum coverage result in effective, cost and time efficient mechanism. In the next section, I will describe my methodology to execute this type of testing.

2. Methodology

A social network is a graph of connected nodes with each other. In a social network, in real life, each node may be denoted a living person and each node is connected with other nodes as per their interaction and social behavior. A typical social network graph is shown as below

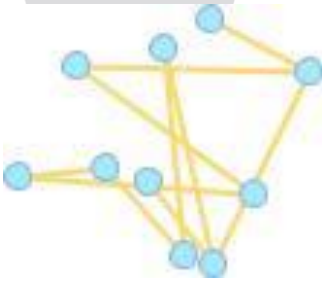


Fig. 1

A social network graph may be denoted mathematically as below

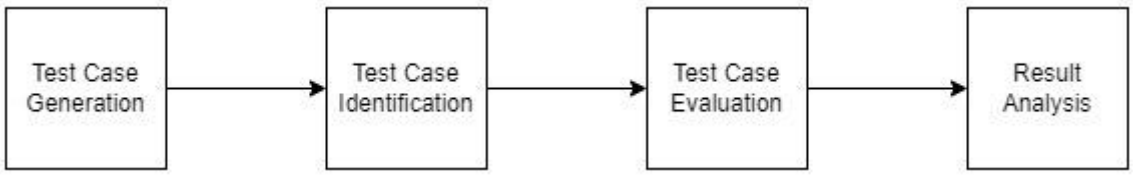
G=(N,E) (1)
Where G is the name of Graph, N is the vertex or node and E is the edge or connection between two nodes.
Vertex set N= N(G) (2)
Edge set E= E(G) (3)

Any social network starts with one single person or with single node N. As new relations joins, the graph or the network keep on expanding. And for some people the connection or node strength goes into millions or even more. And generally social network of a person keep on changing over time. In most cases it expands rather than reducing. With the behavior of expanding, the processing and analytical capabilities are also keeping on changing. There are several social networking or graph analytical tools available such as Gephi, Pajek, R NodeXL or Guess.. But I would consider here any social network analytical tool whether it is already developed or a developed software specifically for social network analysis purpose.
Certainly there are bugs or faults in any software for the purpose of social network analysis. To identify and remove these faults , different software testing tools are available and software testers use these tools depending upon their requirement, feasibility, technicality, financial, aspects etc.
Social network graph and analysis is not constant and keep changing over time Moreover the data of nodes becomes large enough. In our testing model these nodes are considered as data sets. In software testing, data sets are the combination of data elements given to a system as an input to test its functionality. Depending upon the nature and volume of application I propose to use pairwise combinatorial testing as a testing mechanism. Combinatorial testing is a type of black box testing where numbers of input parameters are large and in my study number of input parameters are large. If we assume connection of a person from any other person in the network is either connected or not connected is 1 or 0 respectively. If we consider a sample data of the nodes as mentioned in the table below

Table 1 No of test case

	Sample data for possible data items as test cases		
S.No.	***Total No of Connected people in a sample social network (n) under test***	***Relation status 1 Connected, 2 not connected***	***Possible Test Case $T=2^n$***
1	1	2	2
2	2	2	4
3	6	2	64
.	.	.	.
.	.	.	.
n	12	2	4096

As shown in the table above, the number of possible test cases keeps on growing with the increase in number of people in a connected network. So it is very difficult or almost impossible to test each and every test case manually. Other testing methods may not work in this particular case because depending upon the nature of the application, the test cases may not be able to identify the sufficient number of inputs. Depending upon the behavior and data sets, I propose the following steps in pairwise combinatorial testing.



As shown in the diagram above, this model shall broadly comprise the steps as mentioned - initially the test cases will be generated based upon the total number of people connected s in the network. Once the test cases are generated, the identification of test case shall be initiated for selection of most suitable set of test cases. Once the selection of test cases has been initiated, the evaluation process starts. In the evaluation process, it shall be ascertained that the test cases, which have been identified for testing purpose are valid in all respects so that the testing process may take place. And the last step is to analyse the result and to ascertain if any further testing is required.

3. Conclusion and Future Work

I have tried to identify the optimal and effective testing method for social network analysis tools. Depending upon the input parameters and volume of test cases, the pairwise combinatorial testing is most suited. This most is also suitable because it will reduce the test cases significantly. It will enhance the coverage of test plan in as compare to manual or any other testing method and greatly reduce total number of tests in the social network analysis apllication. It will also enhance the value of each test case

and will be easier to review.Future Work - In future this model may be designed and implemented in the form of an application software, which may convert this testing mechanism into a workable and automated program, that may be integrated with the social network application program and may be able to execute the testing process with least manual processing.

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