A Kidney Algorithm for Pairwise Test Suite Generation

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Pairwise testing can greatly minimize the cost of software testing and also increase the ability of fault detection. Nevertheless, generating the most optimal test suite is an NP-complete problem and still an open area for research. The test case generation is the most active area of the pairwise testing research. Metaheuristic algorithms have been broadly used for solving difficult optimization problems as well as proving their effectiveness to get most optimal solutions. Kidney algorithm (KA) is a recent metaheuristic algorithm. This study introduces a new pairwise strategy by adapting KA; which is the first time to adapt KA in generating the test suite. The proposed strategy is called Pairwise Kidney Strategy (PKS). This study also highlights the PKS design; in addition, compare its performance with other reported strategies in the literature in terms of test suite size. Experiment results show that PKS has very competitive results as compared with other strategies.

Keywords: Combinatorial Interaction Testing, Pairwise Testing, Software Testing, Metaheuristic Algorithms, Kidney Algorithm, Optimization Algorithms.

1. INTRODUCTION

Software systems today have become more complex and may have several configuration parameters. As a result of this, the huge number of possible interactions between the parameters will be generated. To detect all possible interaction, triggered failures and the exhaustive testing has to be done. Nevertheless, exhaustive testing cannot be feasible for real systems. Assume that a system has 20 parameters with two values for each parameter. Thus, the exhaustive testing will be $20^2$ (i.e. 1,048,576 interactions). If each interaction needs one minute to be tested, then, all testing will need more than 60 years to be executed. This will be impossible in the reality.

Combinatorial Interaction Testing (CIT) can relieve the interaction explosion problem of the exhaustive testing. The main idea of CIT is that the most interaction faults can be detected by sample of parameters combination.

This is because most failures are caused by some parameters’ interactions. Therefore, CIT aims to generate a sample test cases that cover all possible interactions of a system’s parameters. CIT testing can be a method that can drop the costs and raise the effectiveness of software testing which have been proven to be an effective testing strategy for different types of applications. Pairwise is one type of CIT when each combination has only two parameters. The significant idea beyond the pairwise is that the failures do not be caused by every parameter. Meanwhile, the most defects that are produced, as a result of the interactions between two parameters according to investigation.

Generating the most minimum a sample test cases that covers all the interactions between the parameters is an NP-complete problem. Thus, the combinatorial test case generation is an active research area of CIT. Researchers have used different optimization algorithms to select the sample test cases (i.e. most optimal solutions) that cover all interactions. Metaheuristic algorithms have been broadly used for solving difficult