CHAPTER 7

RESULTS AND DISCUSSION

This section discusses about the salient features of the proposed three test optimization approaches namely Test Sequence, Test Case and Test Suite optimizations and the performance of the algorithms proposed in them.

Among the proposed approaches, test sequence optimization approach leads to optimization in terms of length of the test sequences and cost and time needed in the testing process. From the evaluation results, it has been identified that, the cost associated with the test sequences generated using ISA is less when compared to ACO based test sequence optimization. ACO when compared to ISA lacks the branch coverage criterion. As the problem complexity increases, the number of states in the SUT also increases, which in turn increases the length of the test sequences in the case of ACO; whereas, the length of the test sequences in ISA has not shown that much level of increase, since it has the identification of repeated subsequences in the generated test sequences. During the initial test run, both the algorithms take at most same amount of time for selection of the test sequences. But during the subsequent runs, ISA takes only less time when compared to ACO. This is because of the fact that, the knowledge base is updated automatically and seamlessly through blackboard based learning without any user intervention. By applying this approach, one can achieve at least 50% of reduction (approx.) in the length of the test sequences when compared to ACO.

In the case of Test Case Optimization, the quality of the test cases is improved from generation to generation in the proposed HGA based
approach. The results of the case studies indicated the superiority of HGA in generating quality test cases when compared to GA and BA. Further, the analysis results indicated a reduction of 80.6% (approx.), in the number of test cases needed when compared to GA and BA. The evaluation results of academic problems and industrial strength problems indicate that, the performance of HGA in terms of Mutation Score and Path Coverage is high when compared to GA and BA. Also, the time taken by HGA is lesser than GA but it is slightly higher than BA because of the local search procedure included in it. Even though the optimization process takes time, the test cases generated by HGA consume only less time and resources for performing testing activity since they are few, efficient and quality test cases when compared to other approaches.

In the case of software test suite optimization approach, the proposed ABC based framework, forms an optimal test suite comprises of only a few efficient test cases. The analysis results indicated that, when compared to GA, ABC based test suite optimization showed high coverage with minimum number of test cases within minimal number of test runs. The results gathered from academic and industrial test problems indicated that, even after the number of generations is increased, the path coverage percentage is low in GA. Also, it has been understood that, the optimization of the test cases based on their fitness value is higher and is steadily improving in ABC. Whereas in GA, the test cases improvement is non-linear and usually strikes up at local optima. At the end of the analysis, it has been identified that the size of the test suite is reduced up to 84.7% (approx.) based on path coverage when compared to GA.

Hence, from the results of the performance analysis, it has been identified that, the proposed software test optimization framework based on hybrid intelligence based search approaches outperforms the existing approaches and produces optimal or near optimal solutions.