16. DETERMINISTIC AND RANDOM TESTING APPROACHES ANALYSIS

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In the paper deterministic and random approaches to testing are analyzed. The advantages and disadvantages of both approaches are given. The use of pseudorandom test sequences as a combination of the advantages of deterministic and random approaches is considered. The connection between deterministic and random approaches to testing is shown.

In deterministic testing deterministic input sequences are fed to the object under study. Random or pseudorandom sequences are used in random testing.

A deterministic test sequence is a sequence defined analytically as a recurrent function depending on the previous test sets. Abstract mathematical models exist for deterministic test sequences, which makes it possible to effectively implement them both at the software and hardware level. Such sequences have various properties, including the properties of randomness, uniformity and maximum length. The main feature of deterministic test sequences is reproducibility [1].

A random test consists of random and independent test sets. Test cases are selected, randomly generated from a set of input data [2]. The main advantage of random testing is that there is no need to build a deterministic test – generating a deterministic test may have high complexity and even be

unrealizable. Among the advantages of random testing are also low time and resource consumption, detection of new faults, ease of automation and efficiency in stress and load testing.

However, the test performed during random testing is so occasional that it is very difficult or impossible to recreate the conditions for detecting a specific defect. Random testing does not make it possible to reproduce the fault – there is no exact description of it and steps to reproduce it. The most significant disadvantages of random testing also include the complexity of defining test scenarios and high time complexity, while there is no guarantee of the effectiveness of random tests.

In random testing it is impossible or difficult to reform a previously generated random test sequence to reproduce an experiment, so pseudorandom sequences are used. A sequence of non-random numbers is called a pseudorandom if it has all the properties of a random sequence. Pseudorandom sequences are essentially deterministic and are close to random sequences in probabilistic characteristics [1].

An important feature of pseudorandom testing is the repeatability of the test experiment while preserving all the main advantages of random testing [1]. Pseudorandom sequences are used to implement random testing and controlled random testing.

Antirandom testing represents the development of random testing. Antirandom testing is based on the generating each subsequent test set using a characteristic, or several characteristics obtained on the basis of previous sets [1]. In random testing each test set must be selected randomly, regardless of previously generated test sets. In antirandom testing only the first test set is randomly selected. Each subsequent test set is formed depending on the previously generated sets by choosing the one that has the maximum distance to all previously completed test sets, and the sequence of these sets is deterministic.

There are various modifications of antirandom testing: adaptive random testing, good random testing, mirror random testing and other solutions. Antirandom testing and its modifications are used to increase the effectiveness of random tests and have received the general name – controlled random testing [3].

Controlled random testing is a random test sequence in which the next test set is formed as different as possible from all previously generated sets [4]. The key feature of controlled generation of random test sets is information extracted in the form of certain characteristics (metrics) from previously generated test sets. This information is used to form the next test set.

The main disadvantage of antirandom testing and its modifications is their high computational complexity. The implementation of the antirandom method of constructing tests requires listing all possible input tests and calculating the distance for each potential candidate for the next test sets [1]. In controlled random testing it is also difficult to determine the next test set in relation to the previous test sets.

In conclusion, it should be mentioned that deterministic, random, and pseudorandom testing approaches are widely used in practice. It is important to emphasize that the approach to testing should be chosen based on the characteristics of the object under study and the testing conditions.

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