

Structural Testing, Random Testing, and Statistical Structural Testing

Random testing is one of the more common test strategies. It does not assume any knowledge of the system under test, its specifications, or its internal design. This technique is insufficient for validating complex, safety-critical or mission-critical software.

The structural testing approach systematically derives the test procedures from the external and internal specifications. Therefore, the term test design best describes the mental activity behind this method. The structural testing approach divides the input data space into subdomains. The criteria for this partitioning are given by the external specification of the system. Each subdomain is an equivalence class which is tested by choosing some representatives. But what if the subdomain is heterogeneous, has unknown side effects, or includes errors if executed in a particular order? (A heterogeneous subdomain includes both good and bad data points. Good means that the system works as specified, whereas bad data leads to system failure. For example, in the heart rate alarm test described in the accompanying article, the high alarm limit domain may contain data points that, when applied to the patient monitor, produce no high limit alarm. Other data points may behave as expected). Unfortunately, the subdomains are seldom homogenous or disjoint.

Waeselynck & Thévenot-Fosse¹ showed that a statistical component has to be included to provide a sufficient test data set for a subdomain. This approach is known as statistical structural testing. Our experience has shown that this strategy leads to the best results.

Reference

1. H. Waeselynck and P. Thévenot-Fosse, "An Experimentation with Statistical Testing," *Proceedings of the 2nd European International Conference on Software Testing Analysis & Review*, 1994.

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