

## **Handling Combinatorial Explosion in Software Testing**

Combinatorial explosion occurs frequently in software testing. It arises when a System Under Test (SUT) has several parameters, each with many possible values. The number of combinations of parameter values (i.e. potential test cases) quickly becomes too large to test exhaustively.

This seminar presents a custom-designed test process to handle combinatorial explosion. Major steps of this process include but are not limited to (i) selection of a suitable level of coverage (for instance pair-wise coverage), (ii) transformation of the specification of the SUT into a suitable format, and (iii) handling situations when some (sub-)combinations of parameter values are incompatible or dependent on each other.

Selection of a suitable level of coverage is based on the priorities of the ongoing project, e.g., whether time to market or product quality is more important. The desired level of coverage leads to the selection of a combination strategy. Combination strategies are algorithms that select subsets of combinations that satisfy a given coverage criterion. Most combination strategy algorithms are easy to automate and several tools already exist.

Combination strategies require the test object to be expressed as an input parameter model (IPM). The IPM usually represents the input space of the SUT but can also cover other properties, such as functionality or state of the SUT.

Application of a selected combination strategy to an IPM results in an abstract test suite, i.e., a list of combinations to use. The tester can cheaply evaluate the size and other properties of the abstract test suite before initiating the costly activities of detailing the test cases.

The seminar is based on a recently published PhD thesis, which both describes and validates the use of the combination strategy test process in general industrial test settings.