7. Model-based testing

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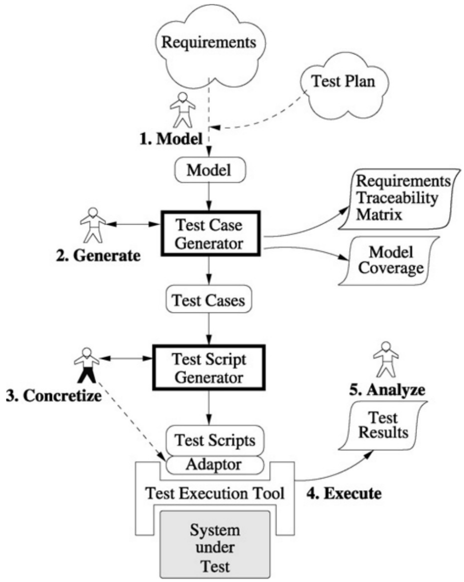
What is model-based testing

Model-based testing has become a bit of a buzzword in recent years, and we have noticed that people are using the term for a wide variety of test generation techniques. The following are the four main approaches known as model-based testing.

1. Generation of test input data from a domain model
2. Generation of test cases from an environment model
3. Generation of test cases with oracles from a behavior model
4. Generation of test scripts from abstract tests

Model-Based testing process



steps for MBT

1. Model the SUT and/or its environment.
2. Generate abstract tests from the model.
3. Concretize the abstract tests to make them executable.
4. Execute the tests on the SUT and assign verdicts.
5. Analyze the test results.

1. Writing the model

- The first step of model-based testing is to write an abstract model of the system that we want to test.
    - ABSTRACT: much smaller and simpler than the SUT itself.
- check that the model is consistent and has the desired behavior.
    - for example using the simulator/animator (and model checker)

Generating abstract tests

- The second step of model-based testing is to generate abstract tests from the model.
- Use some selection criteria for "covering" the model

Test concretization

- The third step of model-based testing is to transform the abstract tests into executable concrete tests.
- abstract tests lack some of the detail needed by the SUT and are not directly executable.
  - spesso fatto a mano (time consuming)
  - This may be done by a transformation tool, which uses various templates and mappings to translate each abstract test case into an executable test script.
  - Or it may be done by writing some adaptor code that wraps around the SUT and implements each abstract operation in terms of the lower-level SUT facilities.

Test execution

- The fourth step is to execute the concrete tests on the system under test.
    - online model-based testing, the tests will be executed as they are produced, so the model-based testing tool will manage the test execution process and record the results.
    - offline model-based testing, we have just generated a set of concrete test scripts in some existing language, so we can continue to use our existing test execution tools and practices.

How to model your system

- The first and most important step in modeling a system for testing is deciding on a good level of abstraction, that is, deciding which aspects of the SUT to include in your model and which aspects to omit.
  - Since the model is just for test generation purposes, it does not have to specify all the behavior of the system.
  - Several smaller partial models are often more useful than one huge and complex model.
- The following are some typical simplifications:
  - Focus primarily on the SUT
  - Include only those operations that you wish to test
  - Include only the data that are useful for modeling the behavior of the operations
  - Replace a complex data field, or a class, by a simple enumeration.

Two possible choices

1. Model only the inputs of your program
    - focus on what are the “critical” inputs of your system and use them
    - PARTITION/COMBINATORIAL TESTING
2. Model also the behavior
    - FSM and FSM-based testing