1.2. Basic definitions

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Testing e Verifica del Software AA 2526

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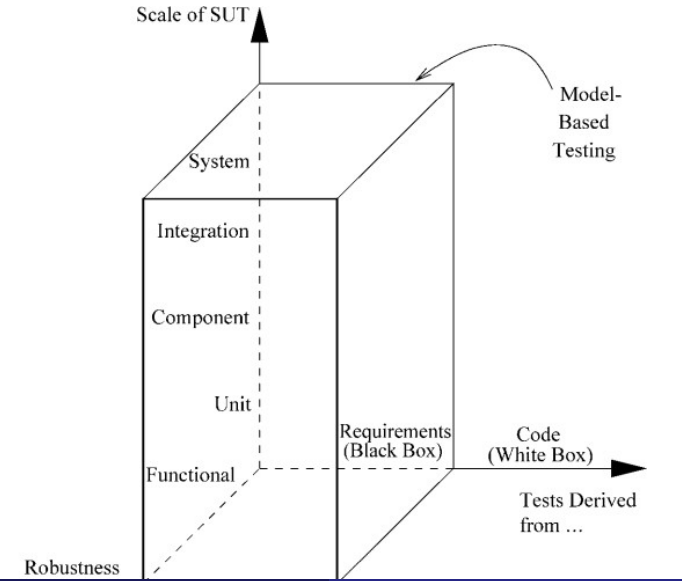
What is testing

Definition by IEE SE Body of knowledge

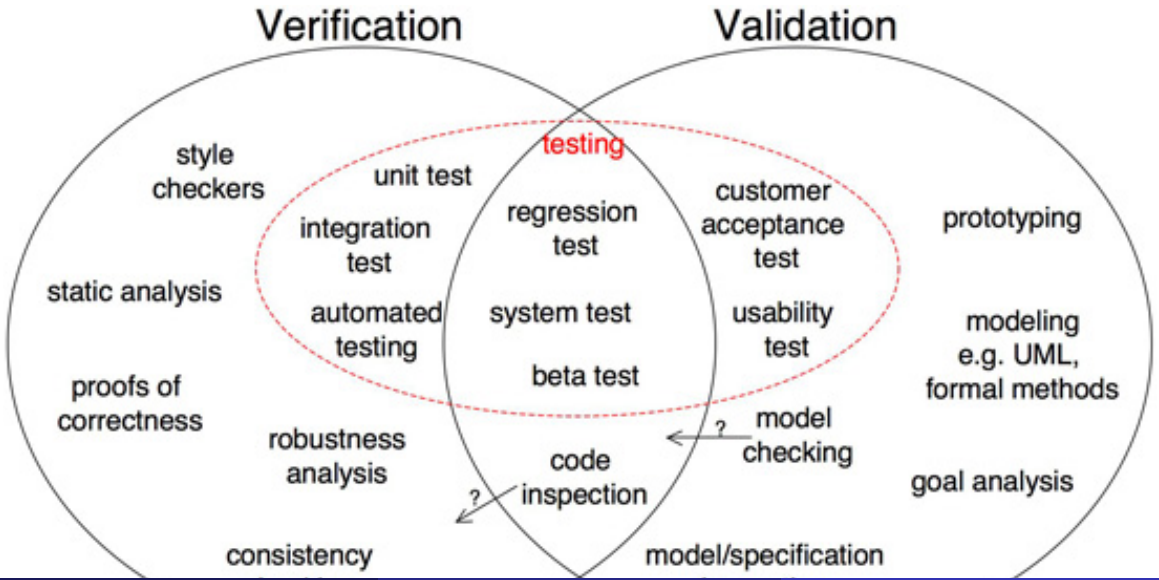
Testing is an activity performed for evaluating product quality, and for improving it, by identifying defects and problems. Software testing consists of the dynamic verification of the behavior of a program on a finite set of test cases, suitably selected from the usually infinite executions domain, against the expected behavior.

Dynamic	it requires the sw to be executed
Finite	only a subset of possible inputs
Selected	selected according to some criteria
Expected	there must be a way to check sw correcteness

What is testing



Is testing verification or validation



What is formal verification

formal verification

techniques that **construct** a **mathematical** proof of **consistency** between some formal representation of a program or design and a formal specification.

construct it is often an human activity (but we will try to automatize)

mathematical based on mathematics and logics

consistency between two "artifacts" (or two roles of the same artifact)

- formal representation of a program or design
- formal specification of the properties the program or design should have

Program verification

- Current practice is to gather evidence for program correctness by testing
- However, exhaustive testing is difficult even for small programs
- Testing cannot prove that a program is correct.
- Program verification can prove that a program is correct
  1. starts with the formal description of a specification for a program (It may be implicit, e.g. a null pointer is never dereferenced)
  2. a proof (in some proof system) that the program meets the formal specification.

Runtime verification

- Checking at runtime that a program behaves as expected.

Formal model verification

- Formal verification is the process of checking whether a design satisfies some requirements (properties).
- The design must be converted in a “verifiable” format. For example a FSM
- The property must be given in formal way

Example

- A light is initially off. If the user presses a button becomes on if it is off and viceversa.
- Model: the FSM
- Properties
  - if the user never presses the button, the light stays off.
  - whenever the light is off and the user presses the button it becomes on
  - whenever the light is on and the user presses the button it becomes off
- differenze con il testing

model checking

- The most popular method for automatic formal verification is model checking.
- Given a model of a system, exhaustively and automatically check whether this model meets a given specification.
- Example: software model checker of Java programs (Java Path Finder) used by NASA