

Software Systems Verification and Validation

Lecture 0 - Black-box testing

Lect. dr. Andreea Vescan

Babeş-Bolyai University
Cluj-Napoca

2015-2016

1 Testing

- Test case design

2 Black-box testing

- Equivalence partitioning (EP)
- Boundary-value analysis (BVA)
- Advantages/Disadvantages

3 Example - black-box testing

- Example - bbt
- Test plan and Test cases in Testlink

4 Test management tools

- Testlink
- Test plan and Test cases in Testlink

5 Next lecture

- Next lecture

6 Questions

Test case design

- Testing is the process of executing a program with the intent of finding errors. [Mye04]
- Achieve this goal:
 - Test cases
 - Test case: “ A set of test inputs, execution conditions, and expected results developed for a particular objective, such as to exercise a particular program path or to verify compliance with a specific requirement.” [IEE90]
 - Black-box testing
 - White-box testing

Black-box testing

- Equivalence partitioning
- Boundary-value analysis
- Decision tables
- Cause-Effect Graphing

Equivalence partitioning

- ❶ Equivalence class (EC) - definition [Mye04]
 - a partition of input domain of a program.
- ❷ Equivalence partitioning
 - to partition the input domain of a program into a finite number of equivalence classes such that you can reasonably assume that a test of a representative value of each class is equivalent to a test of any other value.

Test-case design by equivalence partitioning - steps

- ❶ Identifying the equivalence classes (EC)
 - Valid equivalence classes.
 - Invalid equivalence classes.
 - Default, empty, blank, null, zero, none.
 - Invalid, wrong, incorrect, garbage data.
- ❷ Defining the test cases
 - assign a unique number to each equivalence class;
 - Until all valid/invalid equivalence classes have been covered by (incorporated into) test cases:
 - write a new test case covering as many of the uncovered valid equivalence classes as possible;
 - write a test case that covers one, and only one, of the uncovered invalid equivalence classes.

Test-case design by equivalence partitioning - guidelines

- An input condition specifies a range of values $[a,b]$.
⇒ 1 valid EC, 2 invalid EC
- An input condition specifies the number of values “1 to 3 possibilities”.
⇒ 1 valid EC and 2 invalid EC
- An input condition specifies a set of input values.
⇒ 1 valid EC for each element in the set, 1 invalid EC
- An input condition specifies a must be situation.
⇒ 1 valid EC, 1 invalid EC
- If there is any reason to believe that the program does not handle elements in an equivalence class identically, split the equivalence class into smaller equivalence classes.

Boundary-value analysis

- Boundary-value analysis - definition [Mye04]
 - focuses on the boundary areas of a programs input domain
- Boundary conditions
 - Situations directly on, above, and beneath the edges of input EC and output EC.
 - One or more elements should be selected such that each edge of the EC is the subject of a test.
 - BVA explores situations on and around the edges of the EP.

Test-case design by boundary-value analysis -guidelines

- An input condition specifies a range of values $[a,b]$.
⇒ the ends of the range, situations just beyond the ends;
- An input condition specifies the number of values “1 to 3 possibilities”.
⇒ the minimum and maximum number of values, one beneath and beyond these values;
- An input condition specifies an ordered set of input values.
⇒ the first, the last elements of the set;
- The above rules are applied to the output conditions.

Black-box testing

Advantages

- No knowledge of implementation.
- Tester independent of programmer.
- User's point of view.
- Ambiguities in spec.
- After specifications is completed.

Disadvantages

- A small number of inputs.
- No clear spec. \Rightarrow hard to design.
- Unnecessary repetition of test.
- Many program paths untested.
- Specific segments of code?

Example - bbt

- Problem statement: Compute the number of appearances of the maximum value in an array of natural elements.
- Applied techniques:
 - EP
 - BVA
- See example files on SSVV lecture's homepage

Testlink

- Test management tools - Testlink. (Release 1.9.5)
- <http://www.scs.ubbcluj.ro/testlink/testlink-1.9.5/login>
- Testlink Tutorial - SSVV lecture's homepage

Next Lecture

- White-box testing
- Levels of testing

Bibliografie I

- [IEE90] [Ieee standard glossary of software engineering terminology.](https://standards.ieee.org/findstds/standard/610-1990.html)
<https://standards.ieee.org/findstds/standard/610-1990.html>, 1990.
Accessed: 2016-02-26.
- [Mye04] G. Myers.
The Art of Software Testing, 2nd Edition.
John Wiley, 2004.