Software Systems Verification and Validation
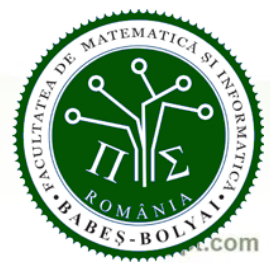
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Lecture 2b: BBT

Outline

- Testing – fundamental questions
- Black-box testing (domain testing)
  - Equivalence partitioning (EP)
  - Boundary-value analysis (BVA)
  - Advantages/Disadvantages
- Example - black-box testing
  - Example – EP+BVA
- Test management tool – Testlink
- Maven
- Continous integration tool - Jenkins

fppt.com

Domain testing

- The problem you have to solve
  - You cannot afford to run every possible test.
  - You need a method for choosing a few powerful tests that will represent the rest.

- Domain testing
  - Provides **a sampling strategy**
  - It provides **heuristics** for choosing a small number of tests that are powerful enough to represent the larger domain.
    - Equivalence
    - Boundaries

- Input versus output variables
  - Domain definitions
    - Specification:
      - Data (X) + preconditions
      - Result (Z)+ postcondition

- Primary dimension versus secondary dimension [BBST]
  - Primary dimension - reflects the reason you are entering data into the field
  - Secondary dimension - reflects the other ways the input can vary

Domain testing (Black-box testing)

- Equivalence partitioning
- Boundary-value analysis

Equivalence partitioning

- Equivalence class (EC) - definition [Mye04]
  - a partition of input domain of a program.
- 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

- Identifying the equivalence classes (EC)
  - Valid equivalence classes.
  - Invalid equivalence classes.
  - Default, empty, blank, null, zero, none.
  - Invalid, wrong, incorrect, garbage date.
- 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.

Domain testing (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.
- Hard to design.
- Unnecessary repetition of test.
- Many program paths untested.
- Specific segments of code?

Surprise!

Domain testing
with
Risk-based testing

Information to study

- **http://www.testingeducation.org/BBST/testdesign/**
  - **Lecture 5: Domain Testing**
  - part D (6 mins, 50 secs)

- **A new table risk/equivalence**
- **http://www.testingeducation.org/BBST/testdesign/testdesign5d.mp4**

Bonus points

- Maximum 25 XP

Information to provide

- Create an example with the new table risk/equivalence
- Poster-based presentation
  - Present the table in Lecture 3 for your colleagues in 5 minutes.
  - Bring it in printed (or written by hand) form for the teacher.
  - A3 page format

Example

- **Problem statement**: Compute the number of participants with the maximum score (0 to 100 points possible) at a competition.

- Applied:
  - EP
  - BVA
- See example files on SSVV lecture's homepage

Maven

- goal - to allow a developer to comprehend the complete state of a development effort in the shortest period of time
- https://maven.apache.org/what-is-maven.html
- Maven
  - The Failsafe Plugin is designed to run integration tests.
  - Maven 2 Integration

Testlink

- Test management tool
  - Testlink. (Release 1.9.8)
- https://www.scs.ubbcluj.ro/testlink

Jenkins

- Continuous integration tool

- https://scs.ubbcluj.ro:9090/

Lecture 2: Required reading (before Seminar 2) + Quiz

Laboratory 2 - discussion

- Testing – Black-box testing/Domain testing (EC+BVA)
  - In class assignments
  - Homework assignments

References

- [PY08] M. Pezzand and M. Young. *Software Testing and Analysis: Process, Principles and Techniques*. John Wiley and Sons, 2008.

- [Mye04] Glenford J. Myers, *The Art of Software Testing,* John Wiley & Sons, Inc., 2004

- [You79] E. Yourdon, Structured Walkthroughs, Prentice-Hall,Englewood Cliffs, NJ, 1979

- [Fre10] M. Frentiu, Verificarea si validarea sistemelor soft, Presa Universitara Clujeana, 2010

- [BBST] BBST Testing course, http://testingeducation.org/BBST/
  - **Test design,**
    - **Lecture 5: Domain testing**

- Tutorials - SSVV lecture's homepage.
  - www.cs.ubbcluj.ro/~avescan

Questions

- Thank You For Your Attention!

Next Lecture

- White-box testing