Automated Test Case Generation

Hello!

We are Team 0x90

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Software Testing is necessary because we all make mistakes. Some of those mistakes are unimportant, but some of them are expensive or dangerous.

The ISTQB

Outline

1. Defining goals
2. Test data generation
3. Test case generation
4. Achieving goals
5. Whole Test Suite vs Single Target

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Terminology

What do all these strange words mean?

Concepts

What is a test goal?

Test goals refer to what you want to achieve when testing something. High coverage can be a test goal with a certain criterion (e.g. branch coverage).

What is Single Target?

The Single Target approach focuses on one specific goal for one target undergoing tests. In OO, it may refer to achieving high branch coverage for one class at a time,

What is test data?

Any data that is used in testing. Data used as input for tests is test data. The expected output is also test data.

What is Whole Test Suite?

The Whole Test suite approach aims at targetting all aspects of a system at the same time. A whole test suite is generated for the entire system, according to one test goal..

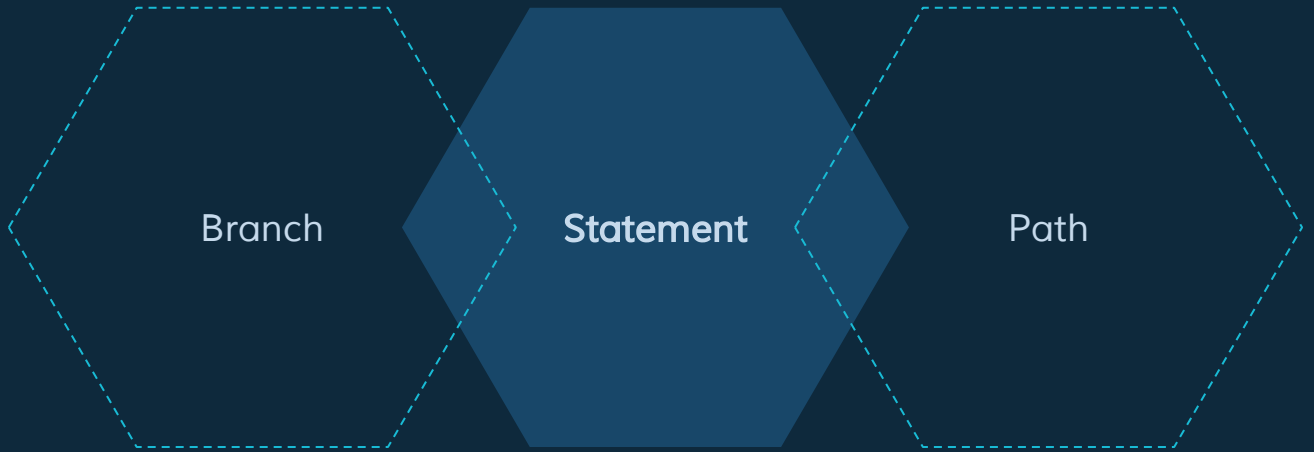
What is a test case?

A test case is a sequence of statements used to test one certain aspect.

1 Defining Test Goals

What do I want to achieve by testing?

Coverage



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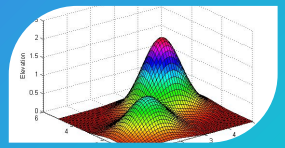
Test Data Generation

What is my input data? What is my output data?



Search-Based Test Data Generation

Applying meta-heuristic search-based optimization techniques to find near-optimal solutions.

Reformulating Testing Goals as an Optimisation Problem

Techniques

- Hill Climbing
- Simulated Annealing
- Genetic Algorithm (e.g. Multi-Objective)
- ...

Types of Testing

White-box

The process of deriving tests from the internal structure of the software under test.

- Symbolic Execution
- (Dynamic) Domain Reduction

Gray-box

Combines both structural and functional information for the purpose of testing.

- Assertion Testing
- Exception Condition Testing

Black-box

Test the logical behaviour of a system, as described by some form of specification.

- Z Specification
- Specification conformance

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Test Case Generation

I have a problem with data; how do I define a solution?

Statements

- Primitives
- Constructors
- Fields
- Methods
- Assignments

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Achieving Test Goals

I have test cases but did not achieve my goal; now what?

Evolution

Evolve a population of test cases with a genetic algorithm and a fitness function that determines when the goal is achieved.

Two Options

Whole

- Start with one goal for a cluster of classes and generate test cases.
- Apply the genetic algorithm on the test cases.

(Generates smaller test suites with higher coverage.)

Single Target

- Start with one goal for one target class and generate test cases.
- Apply the genetic algorithm on the test cases.
- Repeat the process until all classes have been tested.

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Whole vs Single Target

Everything together or one at a time. What is the best approach?

Two Options

Whole

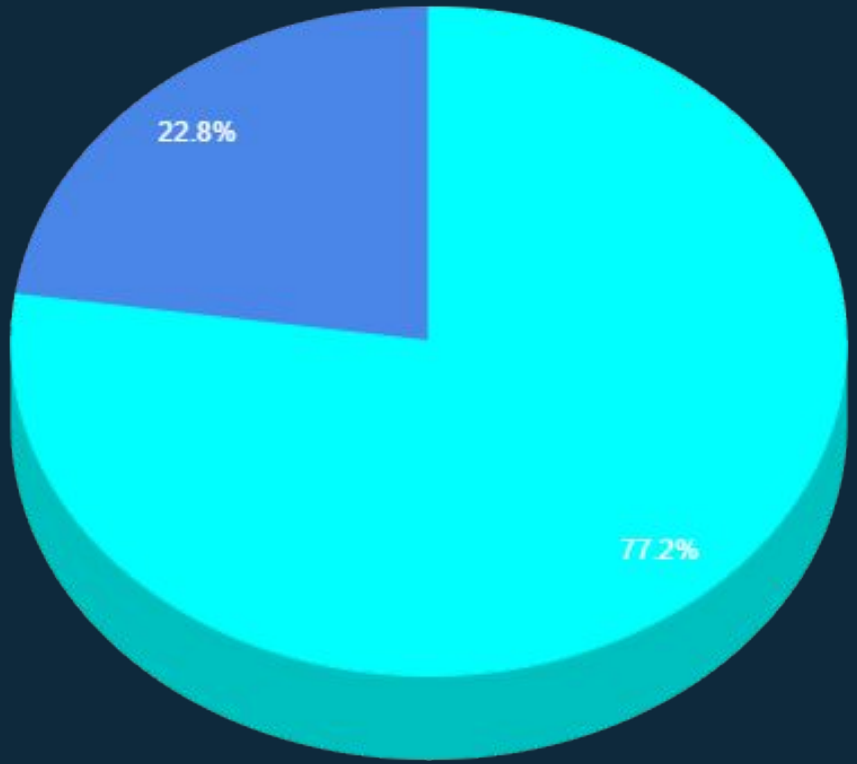
- May never cover difficult goals
- Slightly more coverage does not mean better (e.g. when generated suites are twice as big)

Single Target

- Can waste time on infeasible coverage
- Does not consider collateral coverage

Performance Comparison

	#Branches	$p < 0.05$	Never Covered by the Other
Whole is better	1631	1402	246
Equivalent	671	-	-
Single Target is better	81	58	3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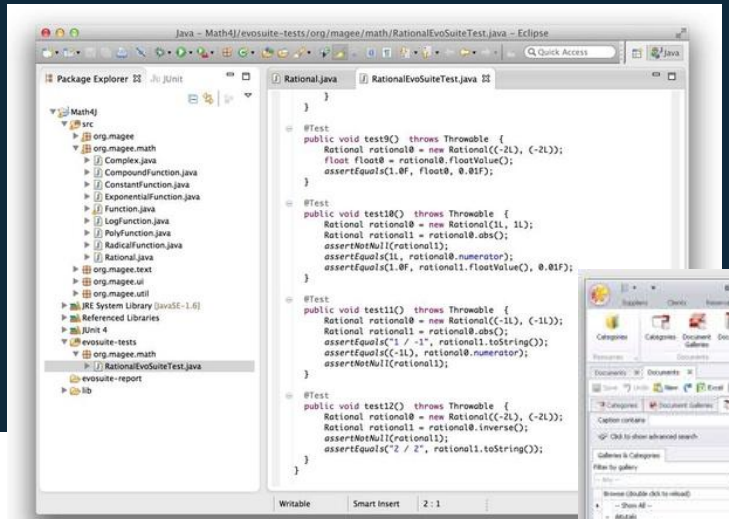

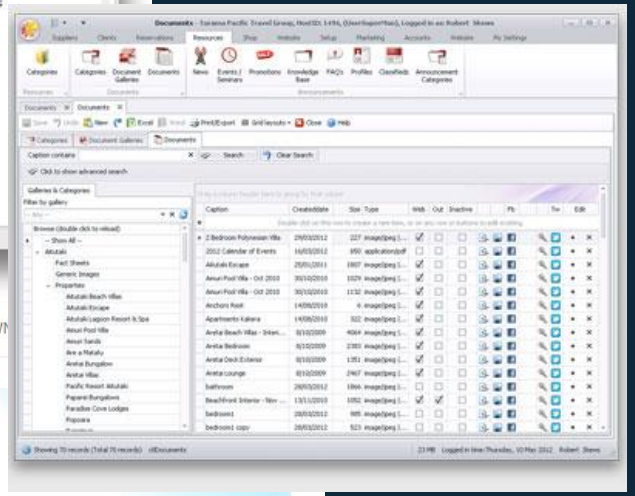

EVOSUITE

Automatic Test Suite Generation for Java

HOME CONTACT ABOUT **DOCUMENTATION** PUBLICATIONS EXPERIMENTAL DATA DOWN

Thanks!

Any questions?

You can find us at:

https://github.com/TUDelft-CS4110/2016-0x90