

CS409

Software Testing

TAN, Shin Hwei

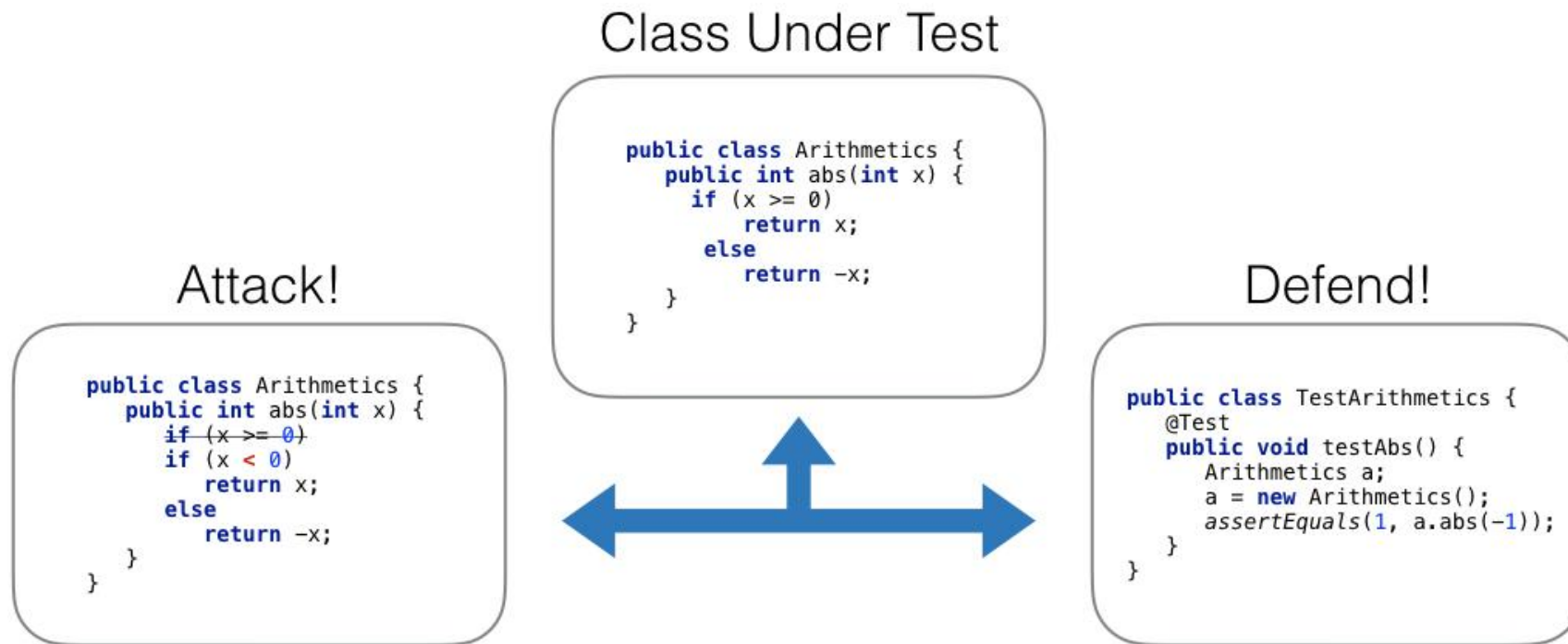
陈馨慧

Southern University of Science and Technology

Slides adapted from Introduction to Software Testing, Edition 2 (Ch 9)

Mutation Testing Game

- Today you will learn about mutation testing through a game!



Introduction to the game

The screenshot shows the Code Defenders website in a web browser. The page has a black header with the Code Defenders logo and a blue navigation bar with 'research' and 'help' links. The main content area features the title 'Code Defenders' and the subtitle 'A Mutation Testing Game'. Below this is a blue 'Enter' button. A diagram illustrates the game mechanics: a central 'Class Under Test' box contains Java code for an 'Arithmetics' class. To its left is an 'Attack!' box with mutated code, and to its right is a 'Defend!' box with a test case. A double-headed blue arrow connects the 'Attack!' and 'Defend!' boxes, indicating the interaction between them. At the bottom, the names of the authors, Thomas D. White, José Miguel Rojas, and Gordon Fraser, are listed next to the University of Sheffield logo.

Code Defenders

A Mutation Testing Game

Enter

Class Under Test

```
public class Arithmetics {
    public int add(int x) {
        if (x == 0)
            return x;
        else
            return -x;
    }
}
```

Attack!

```
public class Arithmetics {
    public int add(int x) {
        if (x == 0)
            return x;
        else
            return -x;
    }
}
```

Defend!

```
public class TestArithmetics {
    @Test
    public void testAdd() {
        Arithmetics a;
        a = new Arithmetics();
        assertEquals(1, a.add(-1));
    }
}
```

Thomas D. White
José Miguel Rojas
Gordon Fraser

The University of Sheffield.

From: <https://www.youtube.com/watch?v=BGOy8FV68Go&t=192s>

Code Defender

- Integrate 3 aspects of mutation testing
 - Create mutants
 - Killing mutants
 - Checking equivalent mutants
- 2 roles:
 - Attackers
 - Defenders

Attackers

- Write mutants (edit source code)
- Prove non-equivalence or accept that it is equivalent

Defenders

- Write JUnit tests for killing mutants
- Claim equivalence of mutants



Rules for Creating Tests

- Tests are limited by the following rules:
 - They cannot contain loops.
 - They cannot make calls to System.*
 - They cannot contain new methods or conditionals.
 - They can only make two assertions each.

Rules for Creating mutants

- Relaxed
 - No calls to System.*,Random.*
- Moderate (I have selected this rule)
 - No comments
 - No additional logical operators (&&, ||)
 - No ternary operators
 - No new control structures (switch, if, for, ...)
- Strict
 - No reflection
 - No bitwise operators (bitshifts and logical)
 - No signature changes

Start Playing!

- Create an account at <http://code-defenders.org/>
- Play against others:
 - Battleground
 - Attackers: 5-6 people
 - Defenders: 5-6 people
 - id: 4767-4774
- Go to <http://code-defenders.org/help> for more informations on the rules

My Games

ID	Creator	Class	Players	Level	
➤ 4767	tansinhwei	SubjectParser	0 Attackers 0 Defenders	Hard	Start battleground game
➤ 4768	tansinhwei	Lift	0 Attackers 0 Defenders	Hard	Start battleground game
➤ 4769	tansinhwei	ByteArrayHashMap	0 Attackers 0 Defenders	Hard	Start battleground game
➤ 4770	tansinhwei	XmlElement	0 Attackers 0 Defenders	Hard	Start battleground game
➤ 4771	tansinhwei	ImprovedStreamTokenizer	0 Attackers 0 Defenders	Hard	Start battleground game

Choosing your Game

My Games

ID	Creator	Class	Players	Level	
➤ 4767	tansinhwei	SubjectParser	0 Attackers 0 Defenders	Hard	Start battleground game
➤ 4768	tansinhwei	Lift	0 Attackers 0 Defenders	Hard	Start battleground game
➤ 4769	tansinhwei	ByteArrayHashMap	0 Attackers 0 Defenders	Hard	Start battleground game
➤ 4770	tansinhwei	XmlElement	0 Attackers 0 Defenders	Hard	Start battleground game
➤ 4771	tansinhwei	ImprovedStreamTokenizer	0 Attackers 0 Defenders	Hard	Start battleground game

- Choose to join between Game with id between 4767-4774