Testing principles and unit testing

219343 Software Testing

Jittat Fakcharoenphol

Kasetsart University

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Outline

Testing principles[1]

Principles provide a general guideline.

[1] Materials from Graham, van Veenendall, Evans, and Black, *Fundamentals of Software Testing: ISTQB Certification*, Thomson, 2007.

Testing shows presence of defect

Exhaustive testing is impossible

Early testing

Example: The Triangle Test[2]

- Given the lengths of three sides of a triangle, determine the type of that triangle.
  - Equilateral
  - Isosceles
  - Scalene

[2] Taken from Black, *Pragmatic Software Testing*, Wiley, 2007

The code that can be tested

Consider this code:

```
package lect02;

public class Triangle1 {

static void checkType(int a, int b, int c) {
  if((a==b) && (b==c))
    System.out.println("Equilateral");
  else if((a==b) ||(b==c) ||(a==c))
    System.out.println("Isosceles");
  else
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public static void main(String [] argv) {
  int a,b,c;
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- How can we test this program, in particular method checkType?
- Automatically? Very very difficult. Because?
- It is hard to check the output of the method.

After some fix

```
package lect02;

public class Triangle {

enum Type { Equilateral, Isosceles, Scalene }

static Type checkType(int a, int b, int c) {
  if((a==b) && (b==c))
   return Type.Equilateral;
  else if((a==b) ||(b==c) ||(a==c))
   return Type.Isosceles;
  else
   return Type.Scalene;
}
}
```

Practice

Find as many interesting test cases for this method.
Write in this form:

Tester action and data	**Expected result**

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We will use this example to talk about good test set again.

Unit testing: classic example[3]

- **John**: John works hard. He codes everyday. The project deadline is tomorrow. He types in about two hundred new lines per hour, and thinks that after 6 hours and roughly a thousand new lines added the program would work flawlessly.

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- **Betty**: Betty works hard. She codes everyday. The project deadline is tomorrow. She types in about one hundred new lines per hour, and keeps testing each method she adds. She does not proceed to write new codes unless all previously written pieces work correctly.

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- **Betty**: Betty works hard. She codes everyday. The project deadline is tomorrow. She types in about one hundred new lines per hour, and keeps testing each method she adds. She does not proceed to write new codes unless all previously written pieces work correctly.
- Guess who will go to bed earlier?

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Developer Testing Revolution

- Developer testing is a key component in a hot paradigm: Agile/eXtreme Programming.

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- The Developer Testing Trinity:
  - Test
  - Test early and often
  - Test well

Good reasons for developer testing

- Reduces unit-level bugs

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- Tests defend against other programmers
- Tests reduce fear

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- Does the code do what I want?
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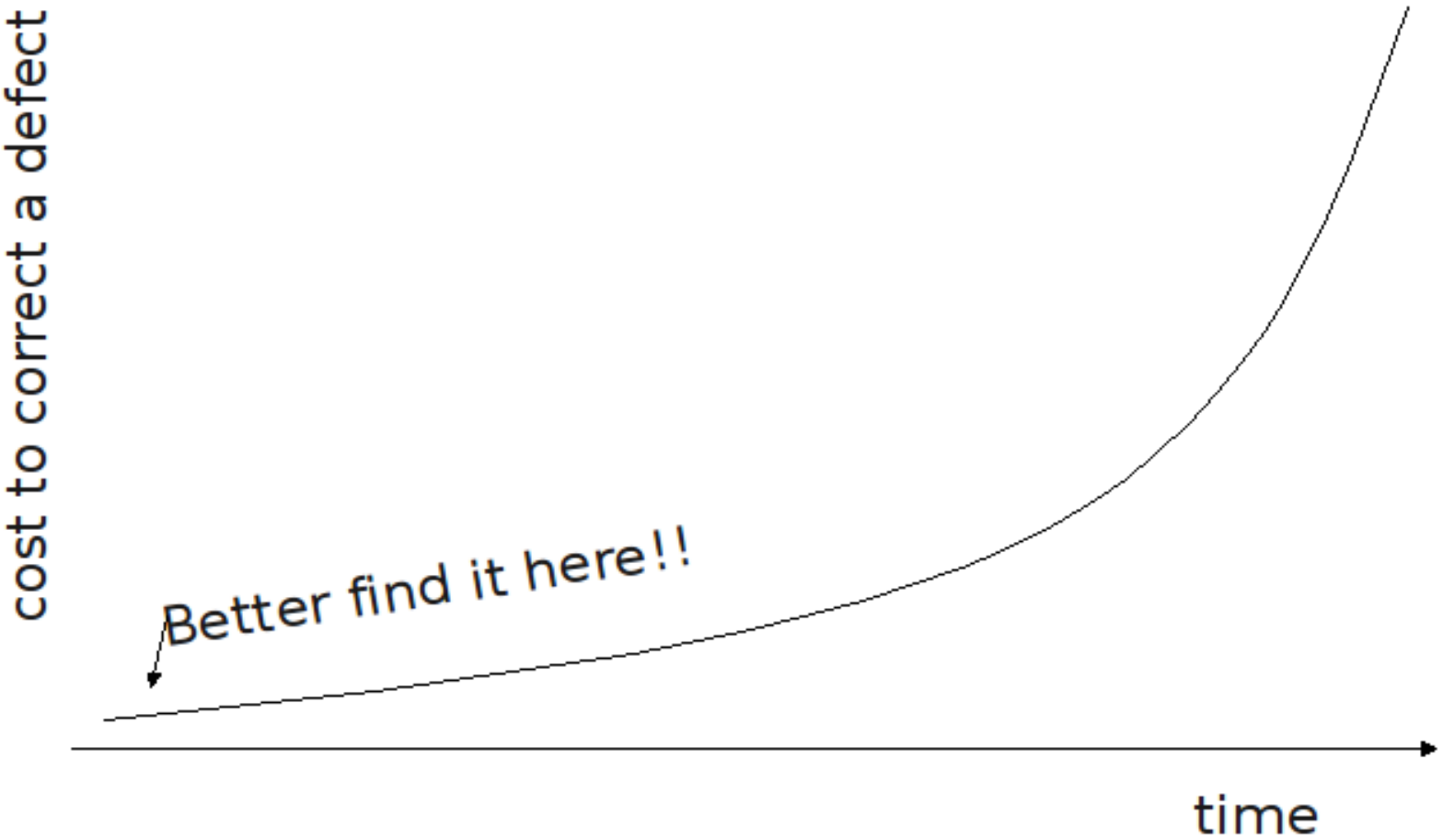
- Can I depend on it?
- Also: get a document for the code.
  Plus: Always correct documentation for your intention.

Test your code

It is your code, and your responsibility

- Do it for your current colleagues
- Do it for future generation of colleagues
- Do it for yourself

Test early and often



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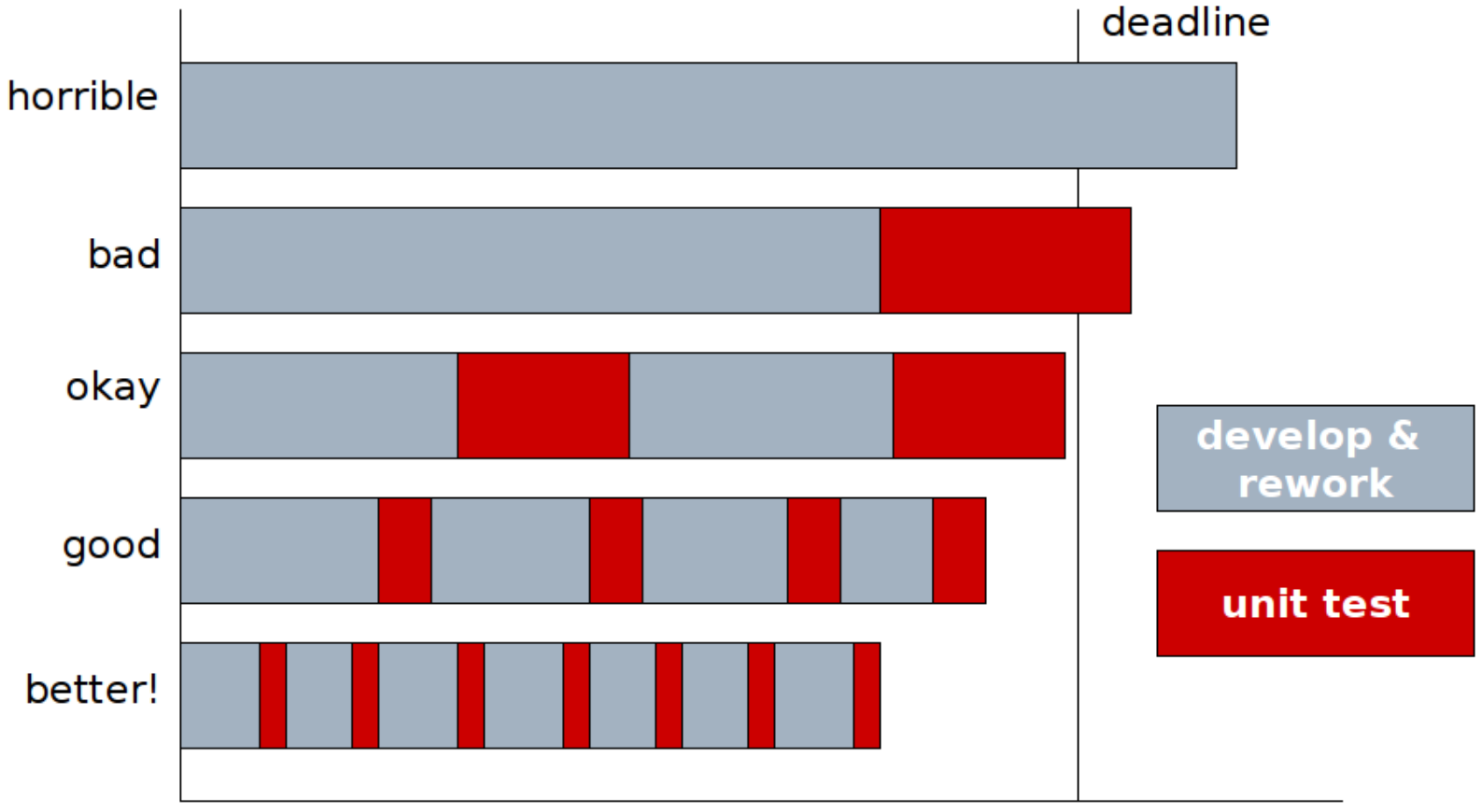

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- The tests are executed many times each day
- The tests are thorough, up to date, and easy to maintain and analyze
- **In this class, we shall aim for that.**

A unit

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  - A single method/function/procedure
  - A collection of related methods/functions/procedues

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- Real world: lots of dependence

Basic structure

- Setup
  - Create initial states
  - Initialize method parameters
  - Store pre-execute values

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  - Store pre-execute values
- Execute code
- Compare results

Practice: Triangle

Write junit test cases for Triangle.

Discussion: test cases for Triangle

What are your test cases?

Test-driven development

- Traditional steps:
  design, code, test, design, code, test, ...

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TDD: Triangle

See demo.

Practice: Median