Traditional unit testing vs Property-based testing

Kasper Liu
Gunnar Applelid

Do you know about these subjects?

...

Online poll in chat....

Why testing?

"Software testing is an **investigation** conducted to **provide stakeholders** with information about the **quality** of the **software**" - Wikipedia

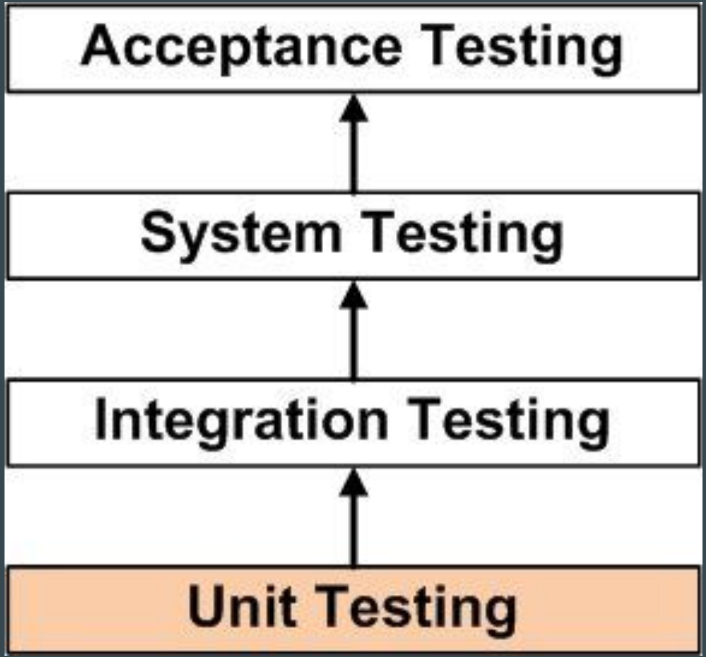
- Find bugs
- Code works after making changes
- Get more trust in our code...

ANYTHING THAT CAN GO WRONG WILL GO WRONG

Murphy’s Law

Traditional unit testing

- Unit is the smallest part of software
- Few inputs and outputs
- Method (object oriented programming)



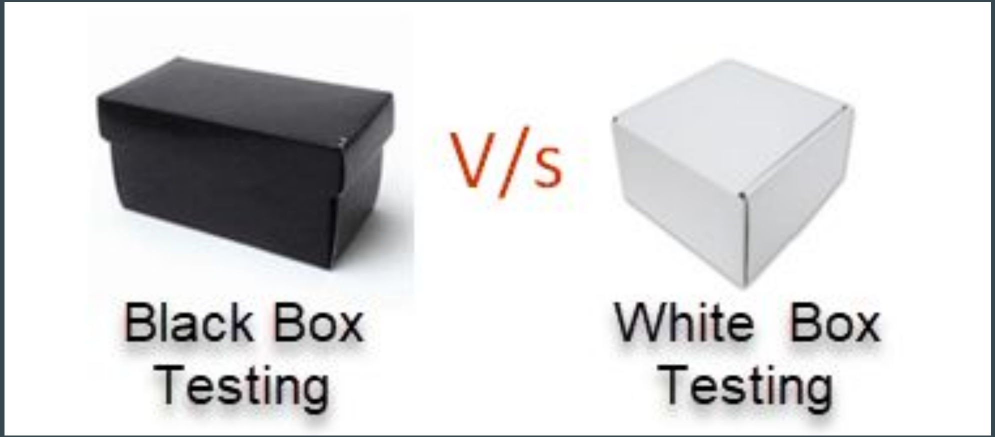
Benefits

- Faster development - No need to start GUI
- Easier debugging
- Write the test first - Think about usage early
- Documentation

Not fun to write unit tests?

It’s like doing the dishes….

White Box Testing



- Black Box Testing - We have **no** knowledge of internal structure
- White Box Testing - We **have** knowledge of internal structure
- **Traditional Unit Testing uses White Box Testing**

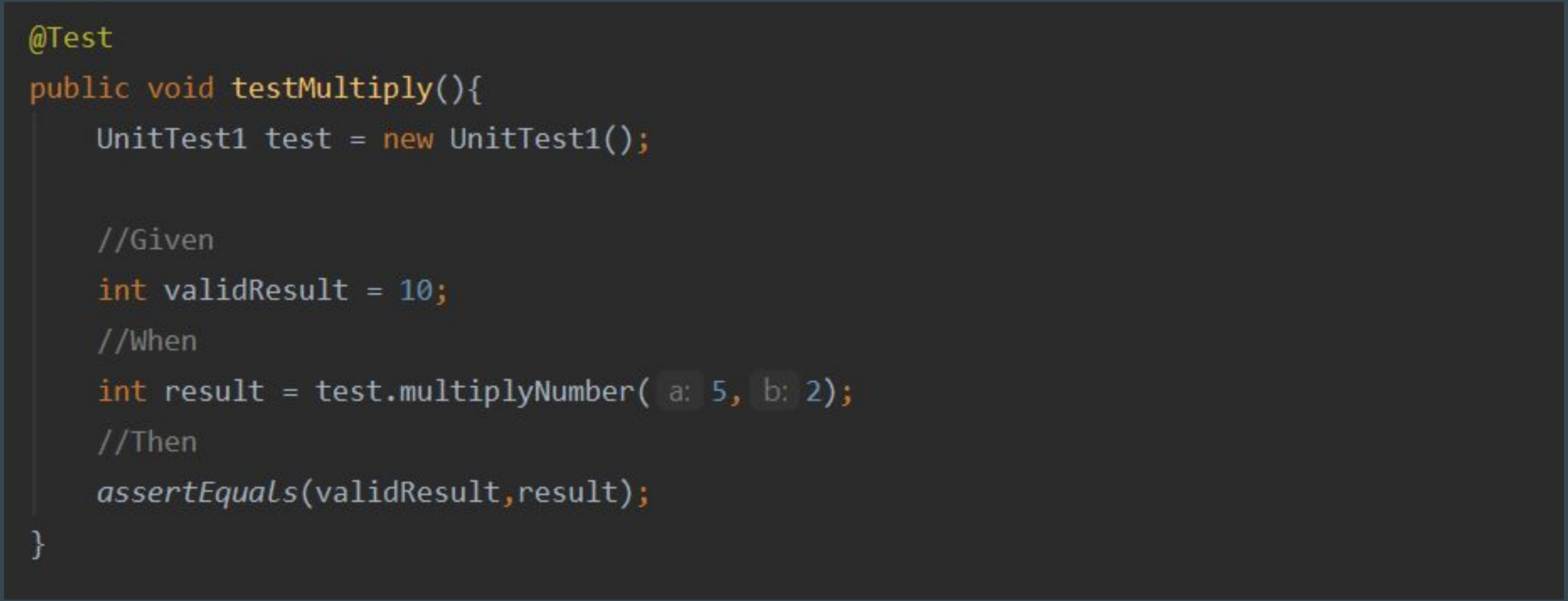
Traditional unit testing - Given, When, Then

Given - some state

When - I perform an action

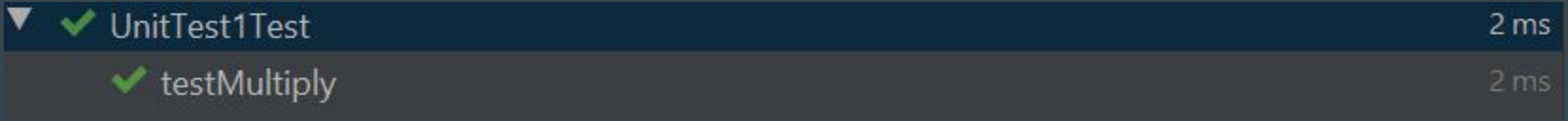
Then - I expect a certain result

Given, When, Then - Example



```java
@Test
public void testMultiply(){
    UnitTest1 test = new UnitTest1();

    //Given
    int validResult = 10;
    //When
    int result = test.multiplyNumber( a: 5, b: 2);
    //Then
    assertEquals(validResult,result);
}
```



```
▼ ✓ UnitTest1Test        2 ms
      ✓ testMultiply     2 ms
```

Property Testing

Generative testing

- QuickCheck
- Quicktheories

Data → Properties

VS

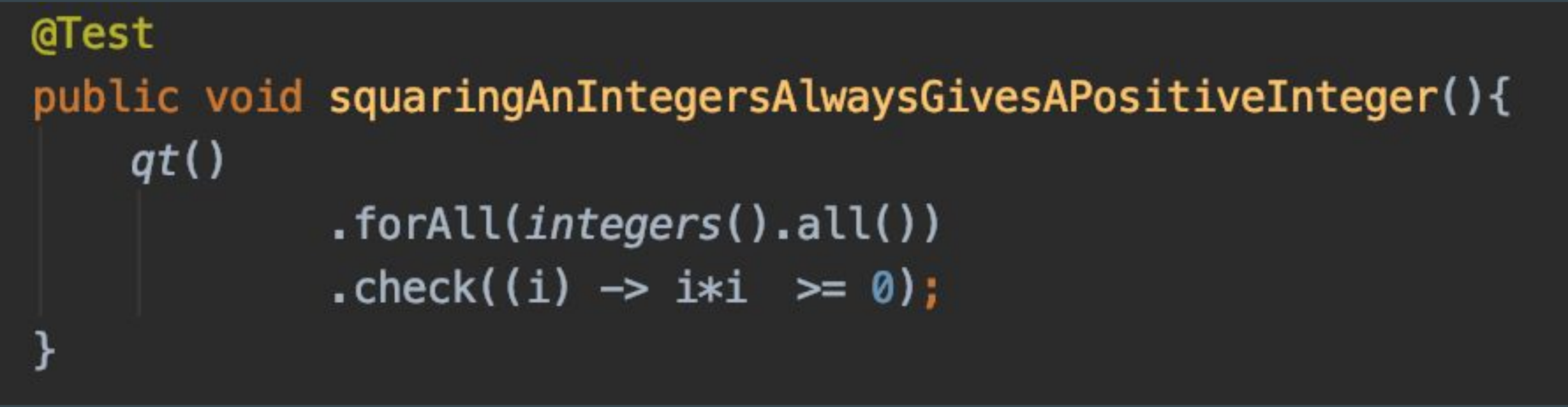
Properties → Data

Property Testing

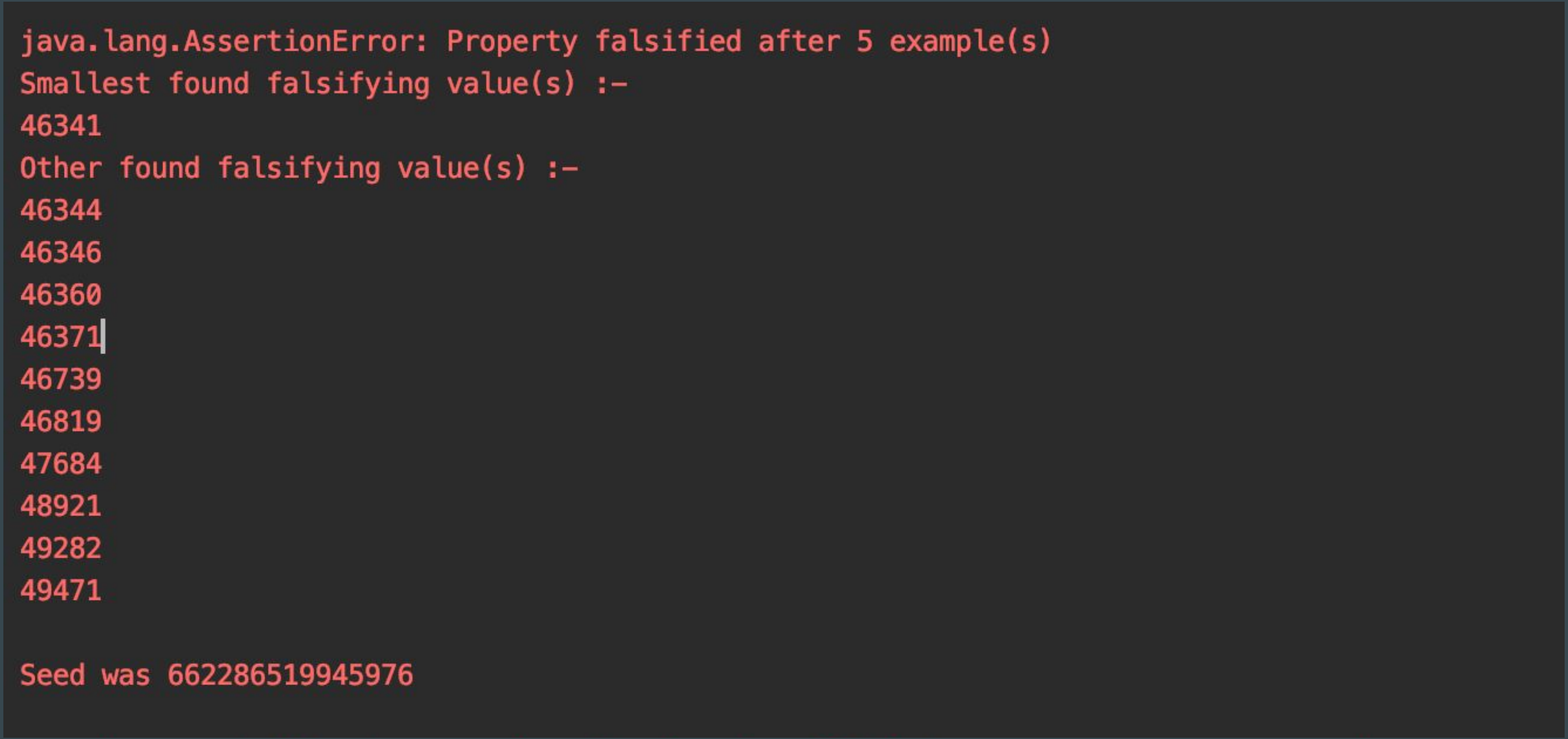
- **For any** input value (x,y,z, ...)
- **Such that** precondition (x,y,z, ...) is satisfied
- **Property** (x,y,z, ...) must be true

Example multiplying integers

- For any input value i
- Such that i is an integer
- i *i >= 0 must be true



```
@Test
public void squaringAnIntegersAlwaysGivesAPositiveInteger(){
    qt()
            .forAll(integers().all())
            .check((i) -> i*i  >= 0);
}
```


```
java.lang.AssertionError: Property falsified after 5 example(s)
Smallest found falsifying value(s) :-
46341
Other found falsifying value(s) :-
46344
46346
46360
46371
46739
46819
47684
48921
49282
49471

Seed was 662286519945976
```

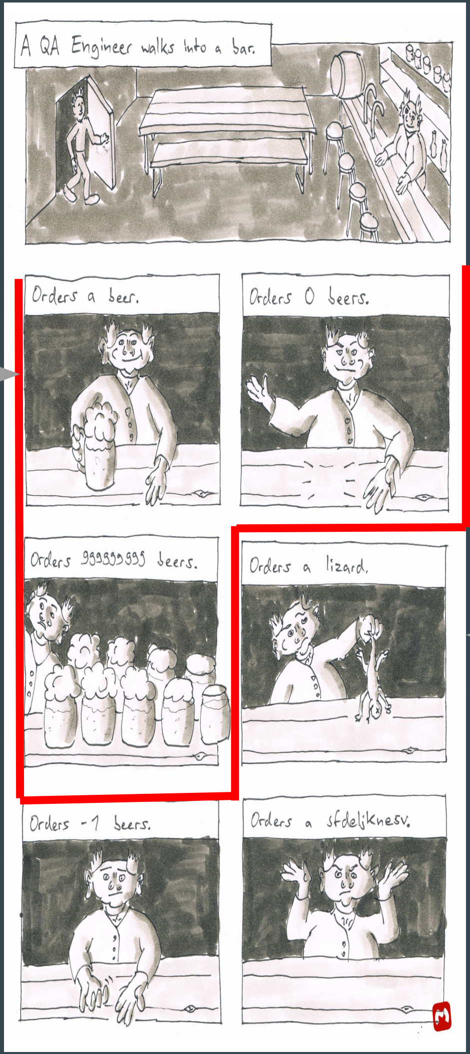
Benefits

- Covers a larger scope
- Shrink the input in case of failure
- Reproducible and replayable

Conclusion

- Edge cases
- Complementary
- Defined values vs Non defined values.

Property-based testing



Unit testing

References

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- Property based testing
  https://www.leadingagile.com/2018/04/step-by-step-toward-property-based-testing/
  https://bit.ly/2J1vpPt

- QuickTheories
  https://github.com/quicktheories/QuickTheories