

Test-Driven Development

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Outline

- 1 Test-Driven Development
- 2 TDD Workflow
 - Workflow
 - Refactoring
- 3 Tools for TDD
- 4 Summary
- 5 References

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Test-Driven Development (TDD)

Basic idea: write the tests before you write the code

- ▶ The tests should fail at the start
- ▶ As you complete the implementation the tests should succeed
- ▶ Testing (and the good test coverage provided by TDD) allows your team to be more flexible
- ▶ Confident in making changes to the system, when your tests pass

TDD Rule of Thumb

Another way of expressing the main rule:

- ▶ Only production code you write is for the purpose of fixing a failing test

What is production code?

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TDD High Level Work Flow

RED-GREEN-REFACTORING

1. Red: Write some tests – Think about one thing the code should do; capture that thought in a test
2. Green: Write the simplest possible code that lets the test pass – Aim for “always have working code”
3. Refactor: Clean up the code you have just written – Aim for nice, clean structure, naming, etc.

What is [refactoring](#)?

The “Red”

First, we write a test

- ▶ This really amounts to design by example
- ▶ We make API decisions
- ▶ We're thinking hard about how code is used
- ▶ We're taking a client perspective
- ▶ We're working at a very small scale
- ▶ Example test for a Stack

```
Stack stack = new Stack();  
stack.push(x);  
y = stack.pop();  
assertEquals(x, y);
```


The “Green”

Then, we just write enough code so that the test case can run

- ▶ We don't write more code
- ▶ All we want is to make the test pass
 - ▶ It should be a very small step
 - ▶ Implementation probably not optimal
 - ▶ We don't care about it (Yet!)
- ▶ Example the test case of the Stack
 - ▶ Write the default constructor, push, and pop, nothing more

The “Refactoring”

And then we refactor

- ▶ TDD Without refactoring likely makes ugly code – thoroughly tested, but ugly
- ▶ There are a variety of transforms/refactoring to address this, but
- ▶ Developing in small increments
- ▶ The Code always runs and past the test cases!
 - ▶ Changes are small enough to fit in our heads
 - ▶ Timeframe is minutes to (maybe) hours
- ▶ Evolutionary design
 - ▶ Anticipated vs. unanticipated changes
 - ▶ Many “anticipated changes” turn out to be unnecessary

Refactoring

A disciplined technique for restructuring an existing body of code, altering its internal structure without changing its external behavior

- ▶ Keeping code healthy with refactoring (meaning?)
- ▶ Refactoring is disciplined – Wait for a problem before solving it
- ▶ Refactorings are transformations – Many refactorings are simply applications of patterns
- ▶ Refactorings alter internal structure
- ▶ Refactorings preserve behavior

Final Step

Making sure the software still works

- ▶ Protection with automated tests
 - ▶ Test harness is only thing that ensures software works
 - ▶ Rerun tests after each change (Regression Testing)
- ▶ Fast feedback
 - ▶ Sometimes, entire test suite is too slow – role of continuous integration servers to execute regression tests in background
- ▶ Management of multiple developers/multiple conflicting changes

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Tools for TDD

- ▶ JUnit
- ▶ Also Continuous Integration Servers, e.g. Jenkins, Travis CI, Github Actions, etc

A demo ...

Let's fire up Android Studio and see how it works ...

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Summary

TDD

TDD workflow

Demo

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References

“Introduction to Software Testing” 2nd Edition. Ammann and Offutt

[JUnit 5 User Guide](#)

[JUnit 4 Getting Strated Guide](#)