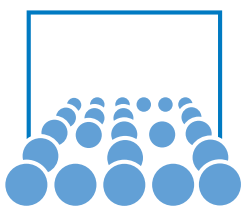
Technische Universität München

TDD: Test Driven Development

Tutorial for Advanced Programming

Friedrich Menhorn

November 17, 2015



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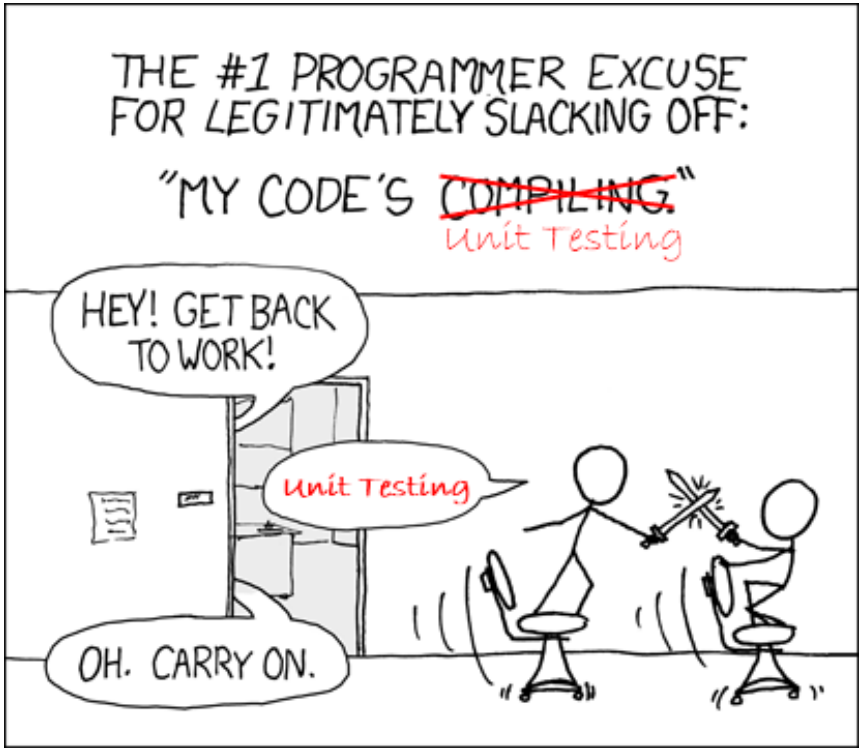
Why do we need testing?



Contents

Assertions

```
#include <iostream>
double divideXByY(double x, double y){
    if(y==0){
        std::cout << "divideXByY: Division by Zero! Exit!" << std::endl;
        exit(-1);
    }
    return x/y;
}
```

Assertions

```
//#define NDEBUG //uncomment to disable
#include <assert.h>
double divideXByY(double x, double y){
    assert(y!=0); // syntax: assert(expression)
    return x/y;
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    assert(y!=0); // syntax: assert(expression)
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```

- Easy and simple way to test during runtime
- Checks if `expression` is true
- On fail, exits program and returns meaningful error message
- Smallest unit to test code

Introduction to Unit Tests

> "If you're good at the debugger it means you spent a lot of time debugging. I don't want you to be good at the debugger." – *Robert C. Martin, Clean Code: A Handbook of Agile Software Craftmanship*

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- Code which tests single units (methods) of the code
- In OOP usually one unit test class per class/interface
- Using assertions in its core
- Executed independently of main program (overnight testing)

Unit tests in a nutshell

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Runner

Unit tests in a nutshell



Runner

- ”Main” class of CppUnit
- Manages the life cycle of the added tests
- Runs the test
- Prints out a trace as the tests are executed

Unit tests in a nutshell



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tuvguy.addTest(test);
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TestSuite("carSuite");
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addTest(testSteering);
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- `setUp()`
- `tearDown()`
- Uses assertions as core

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```
void
testSteering();
```

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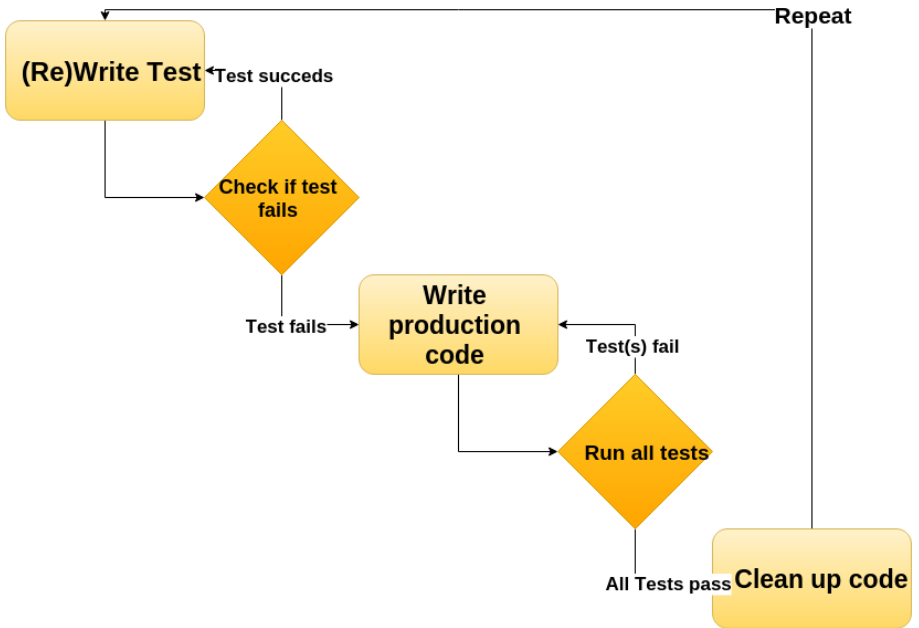
} Quality Control

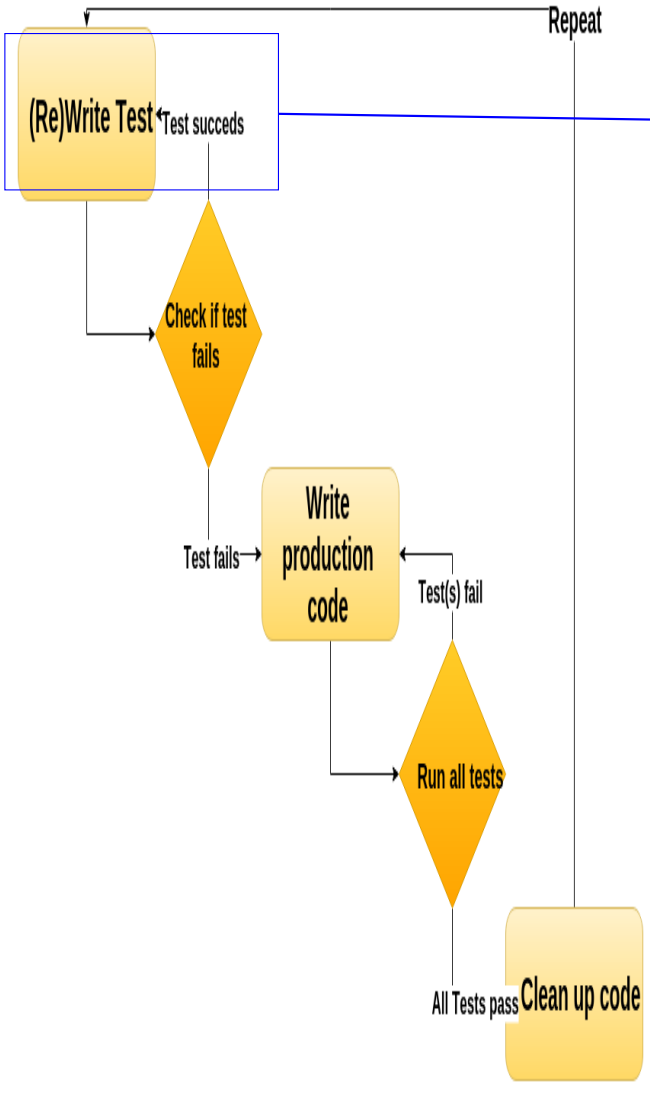
- ⇒ Cleaner development

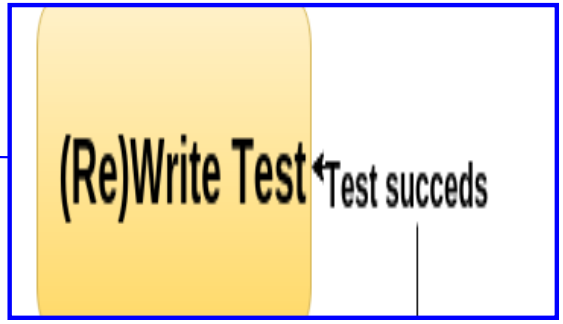
Contents

The three laws of TDD [Clean Code: Robert C. Martin]

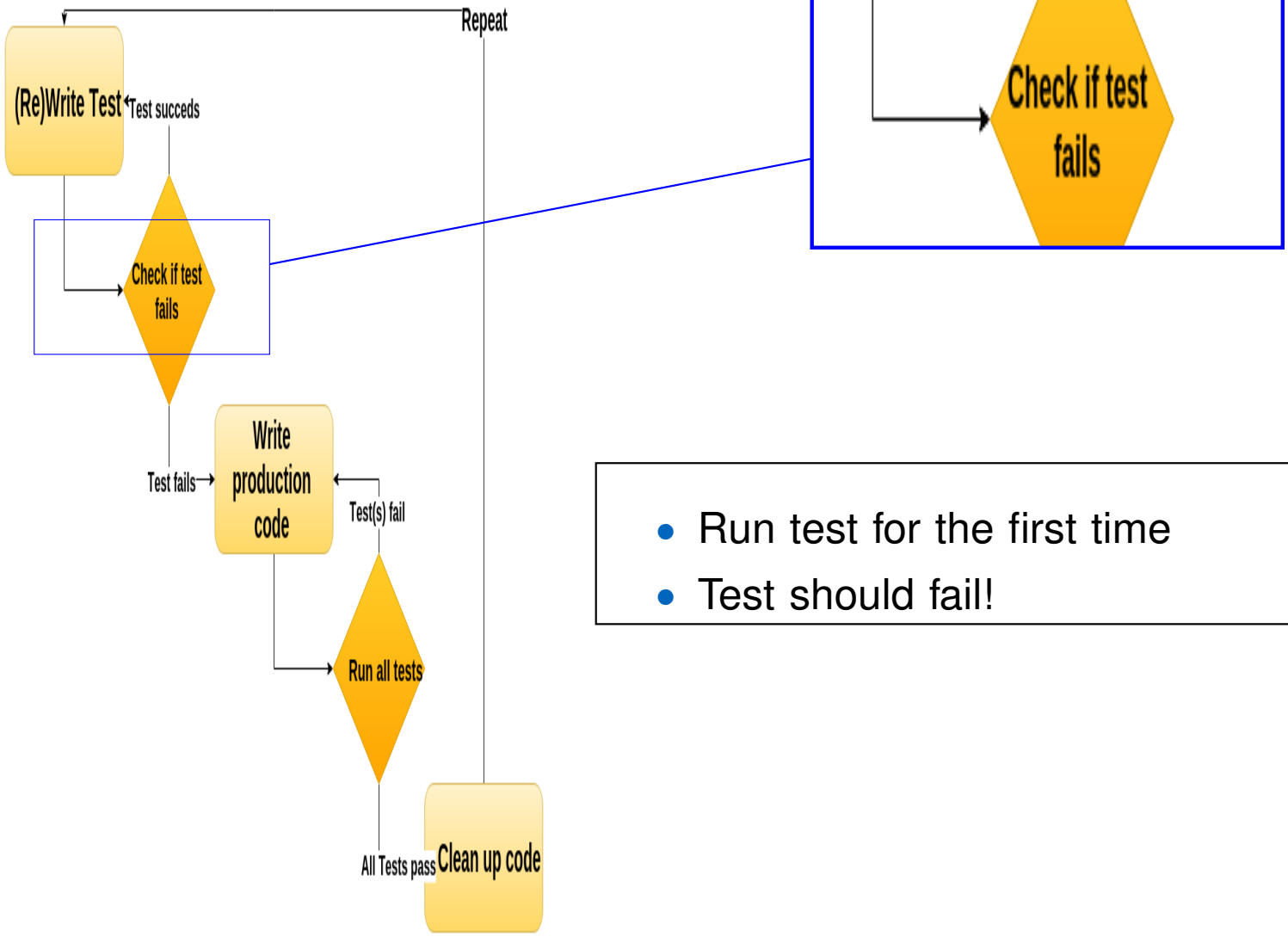
1. You may not write production code until you have written a failing unit test.
2. You may not write more of a unit test than is sufficient to fail, and not compiling is failing.
3. You may not write more production code than is sufficient to pass the current failing test.



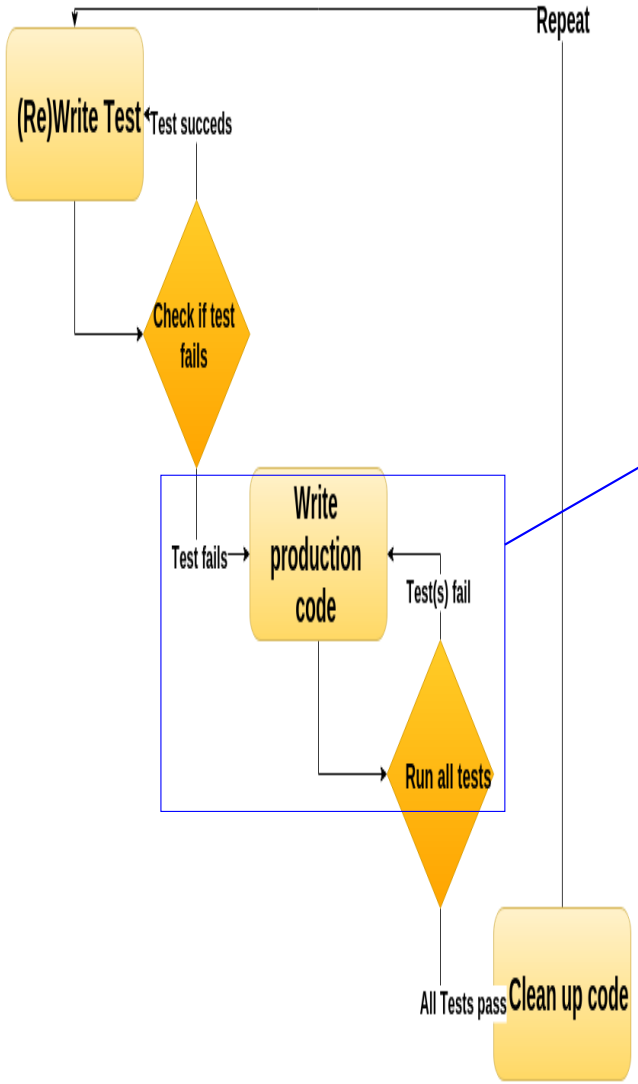


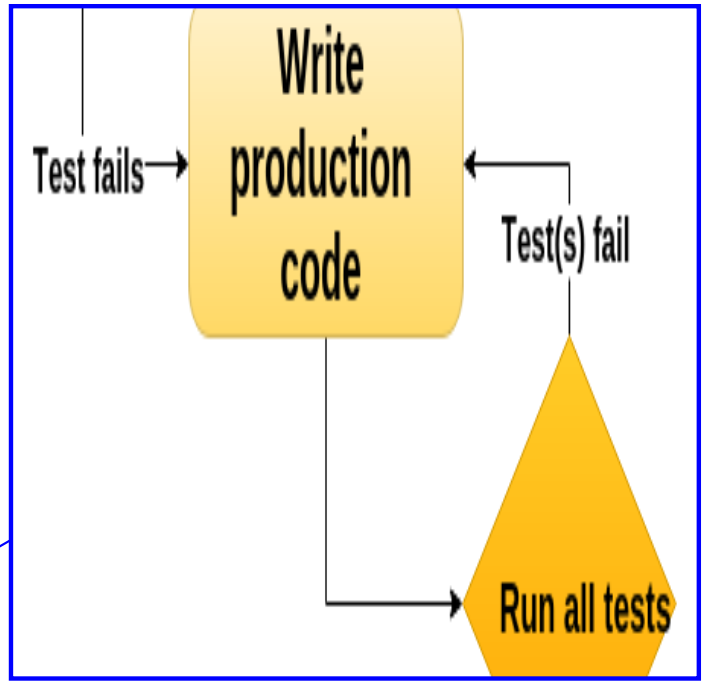


- Before writing any code, first write an automated test for your code.
- Take into account all possible inputs, errors, and outputs.

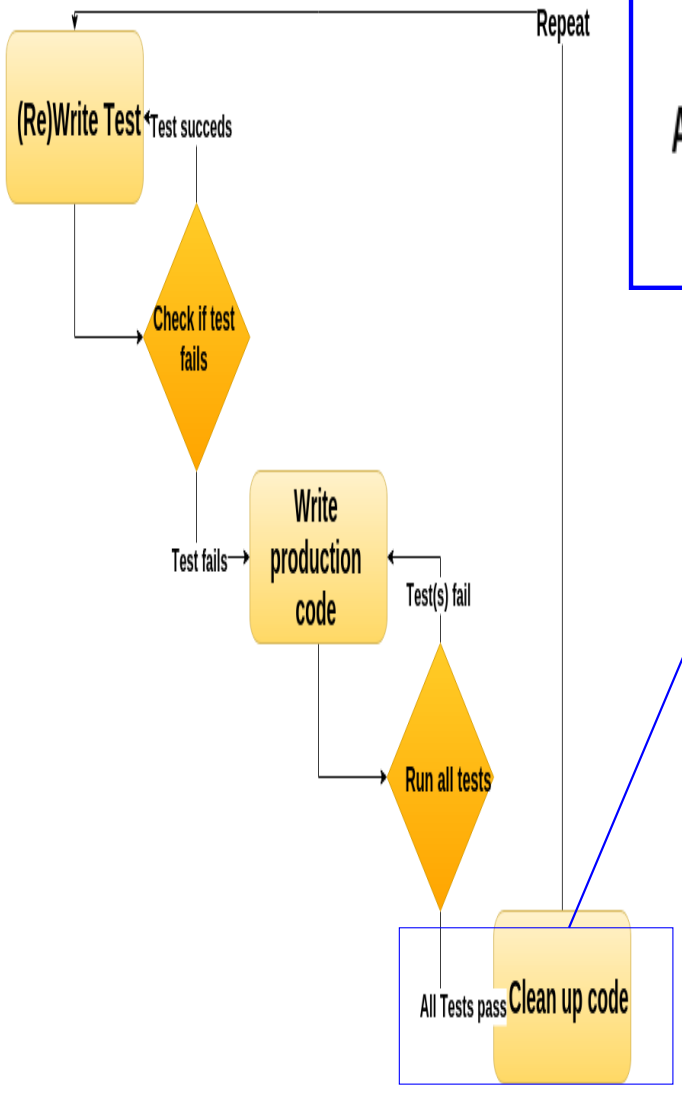


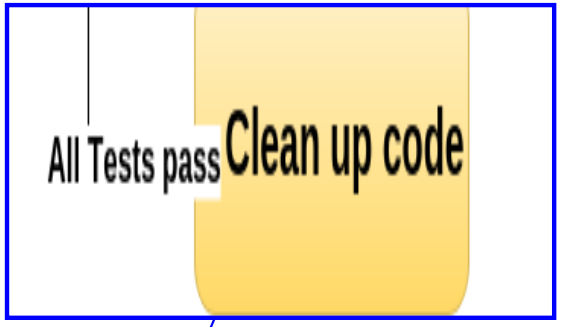
- Run test for the first time
- Test should fail!





- Begin programming...
- As long as the code fails new test, it is still not ready
- Fix code until all assertions are passed





- Once all tests are passed, start clean up code
- If tests are passed $\rightarrow$ code is working
- Repeat

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Let’s ask the internet about unit testing

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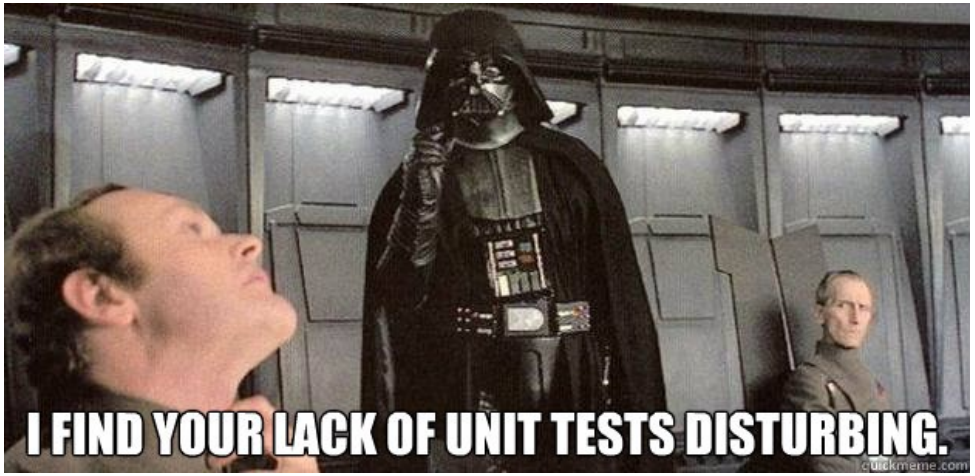

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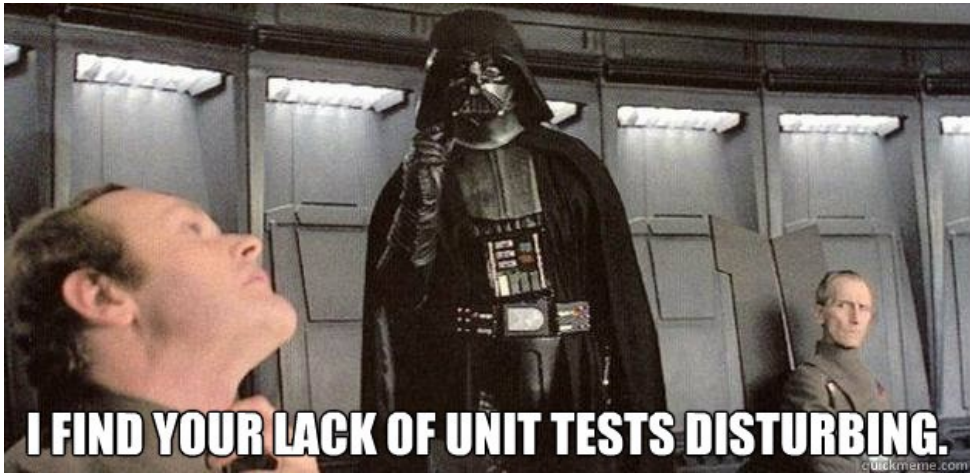

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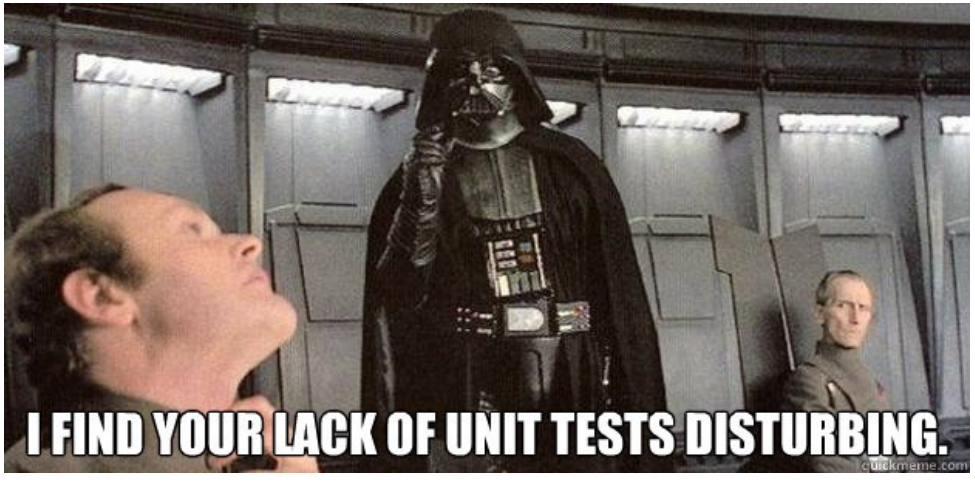

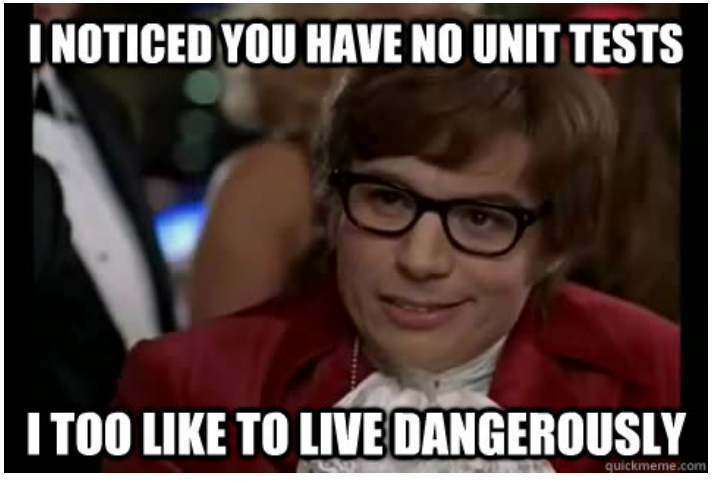

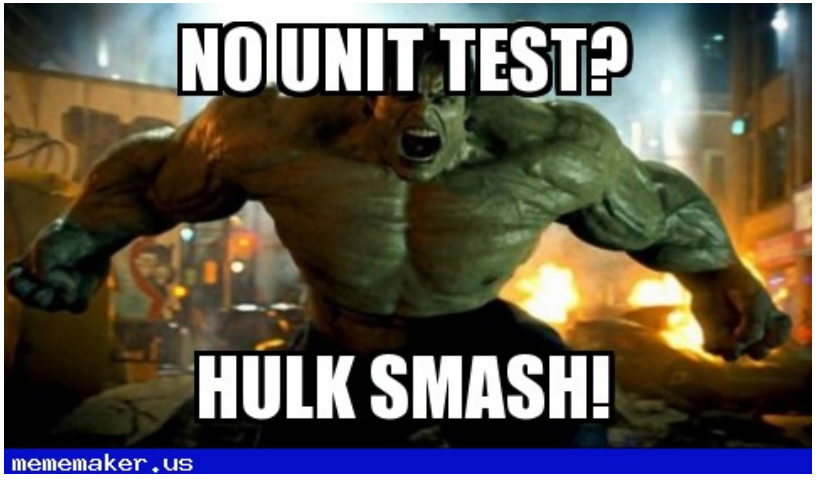

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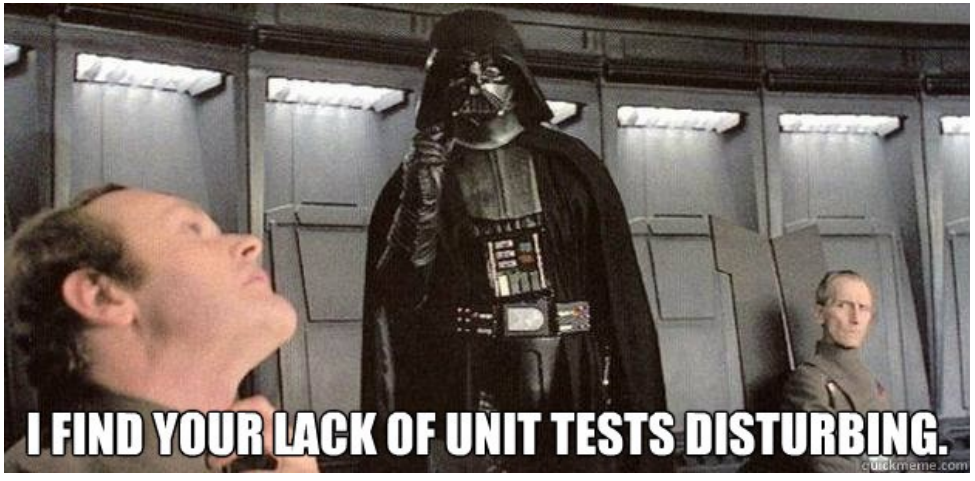

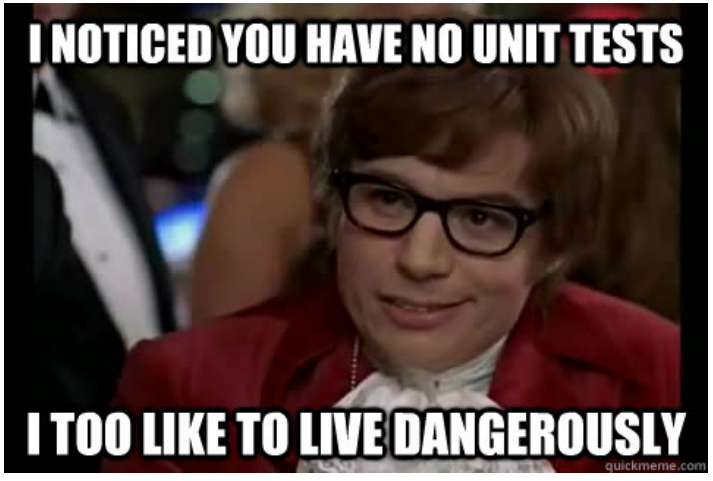

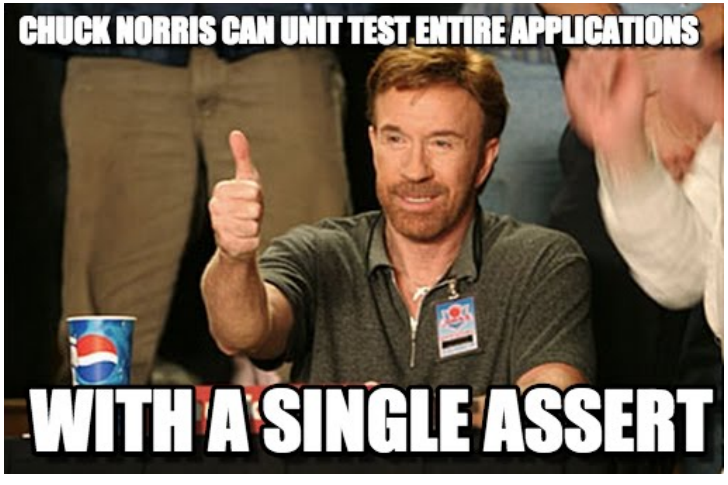

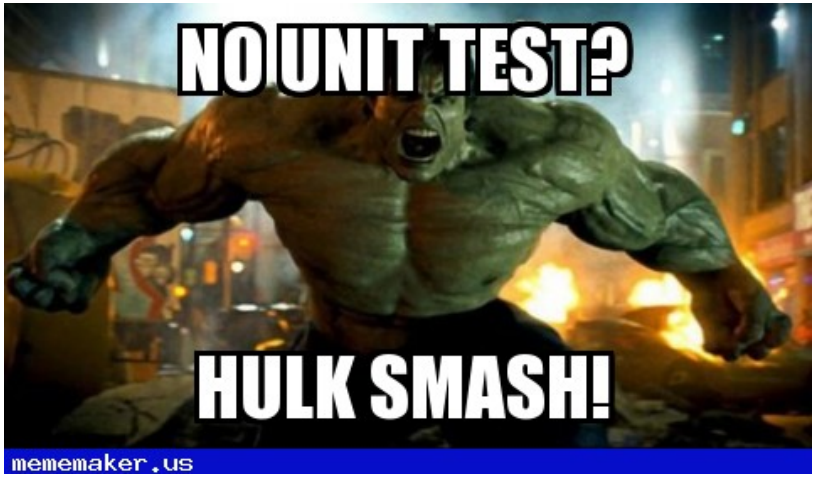

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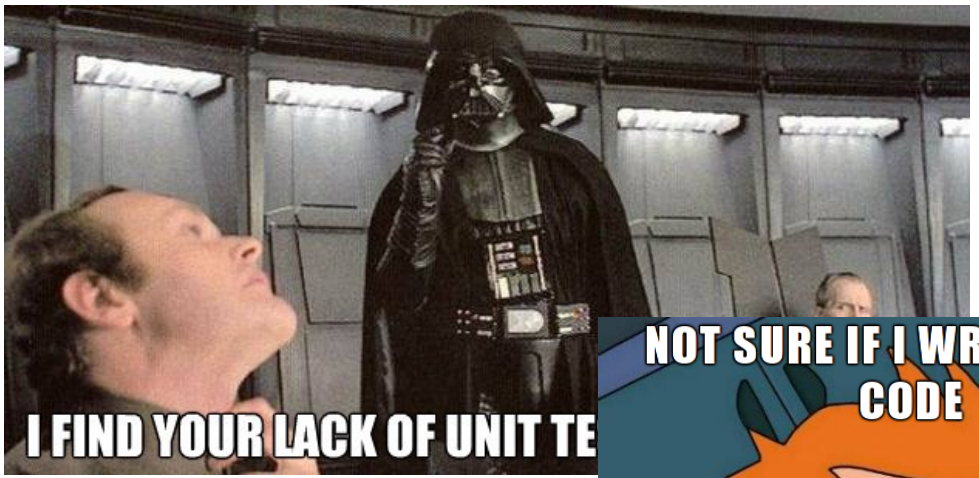

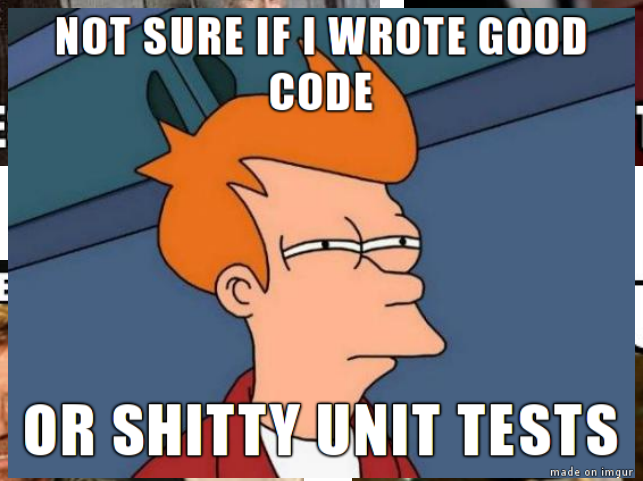

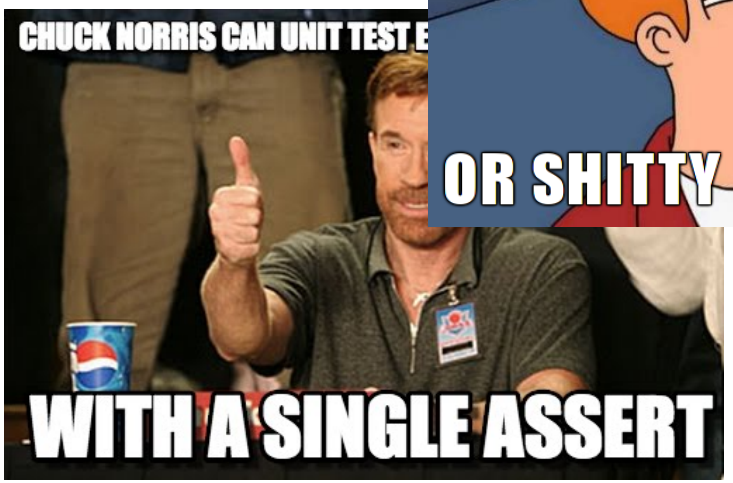

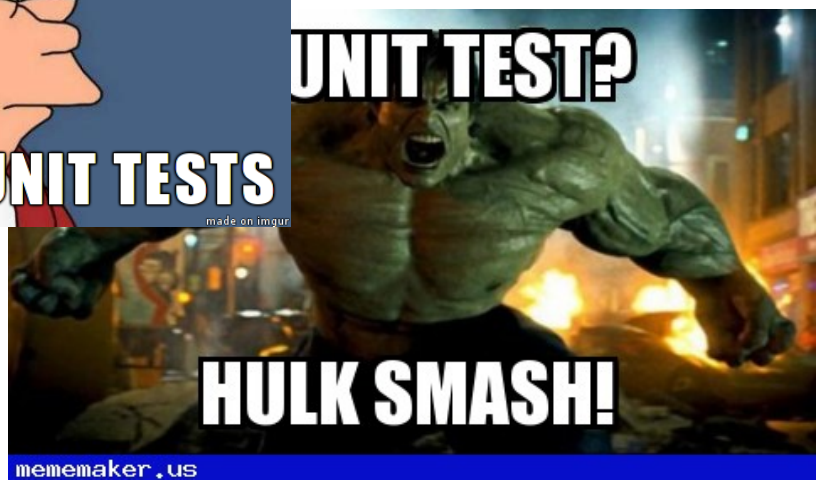

Contents

References for unit tests in C++

- CppUnit: `http://sourceforge.net/projects/cppunit`
- Eclipse CDT (usually not installed by default): `http://stackoverflow.com/questions/16741400/eclipse-cdtplugin-for-running-tests-and-browsing-report`
- Igloo C++ testing framework: `http://igloo-testing.org`
- Google C++ testing framework: `http://code.google.com/p/googletest`
- CUTE: `http://cute-test.com`

CppUnit

- CppUnit: `http://sourceforge.net/projects/cppunit`
- Port from JUnit
- Installation:
  - `sudo apt-get install libcppunit-doc libcppunit-dev`
  - Include linker flag: `-lcppunit`

Structure of CppUnit

Runner class

- ”Main” class of CppUnit
- Sets up the basic test environment
- Manages the life cycle of the added tests
- Runs the test
- Prints out a trace as the tests are executed followed by a summary at the end (optional)

```
Test* test = new CppUnit::TestCaller<your_test>(
    "testA",
    &your_test::testA);
CppUnit::TextUi::TestRunner runner;
runner.addTest(test);
runner.run();
```

Structure of CppUnit

Test suite

- Container for tests
- If run is called, runs its collection of tests

```
CppUnit::TestSuite *test_suite =
new CppUnit::TestSuite( "Name_Of_TestSuite" );
test_suite->addTest( test );
```

Structure of CppUnit

Test class

- Contains the actual tests
- `setUp()`:
  - Called before each test
  - Sets up test environment
- `tearDown()`:
  - Called after each test
  - Destroys test environment
- Uses assertions as core

```
1 class your_test: public CppUnit::TestFixture {
  void setUp();
3 void tearDown();
  void testA();
5 void testB();
  }
```

Structure of CppUnit

Add test

```
test_suite->addTest(
new CppUnit::TestCaller<your_test>(
    "testA",
    &your_test::testA)   );
```

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- Tüvguy, Slide7: `http://kfz-meisterbetrieb-bauer.de/wp-content/uploads/2013/04/tuev1.jpg`
- Car, Slide7: `http://s3-ap-southeast-1.amazonaws.com/first.code.academy.hk/uploads/image/image/4086/1.png`
- Steering Wheel, Slide7: `http://i.telegraph.co.uk/multimedia/archive/02625/Steering-wheel_2625587b.jpg`
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