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UNIT TESTING

Unit Testing as a Philosophy for Success

Elizabeth Groom
@ElizabethAGroom

Slides and code available:

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Microsoft

Developer for CUNA MUTUAL GROUP

We build web sites, API and what ever is needed to support existing applications (some web some desktop)

We work primarily in **C#** and **Angular**, but some applications are in VB.Net and other languages.

Started as an intern software engineer in 2003, and haven’t looked back

CUNA MUTUAL GROUP

What I hope you take away…

- A Good Test Makes for Better Code
- Writing unit tests is almost always worth it

Agenda

UNIT TESTING

1 What

2 Why

3 When

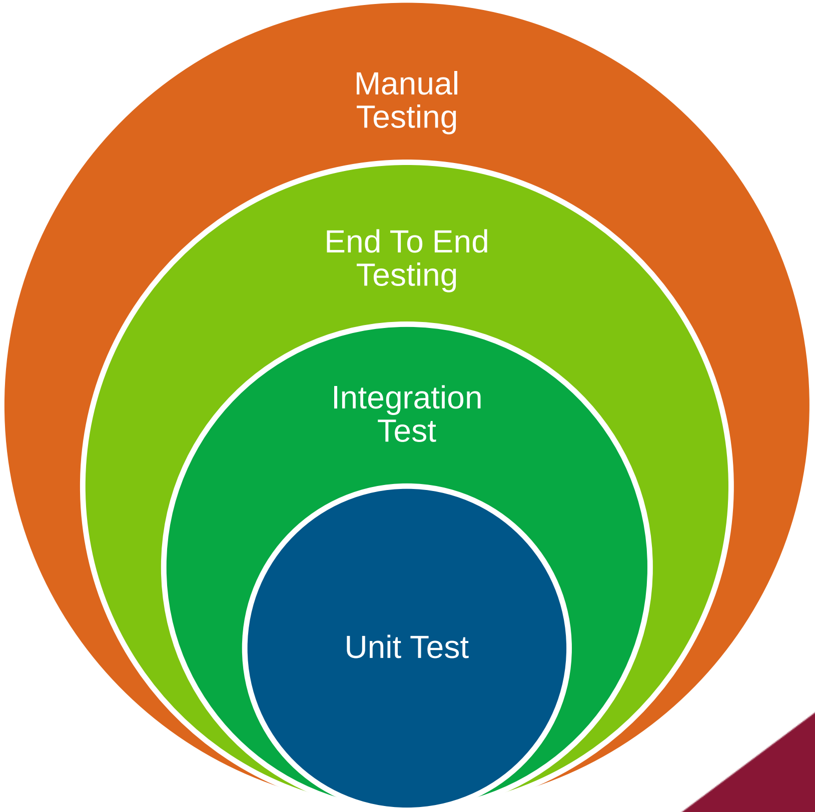
4 Who

5 How

CAN UNIT TEST ENTIRE APPLICATIONS
WITH A SINGLE ASSERT
memegenerator.net

WHAT

Types of Testing

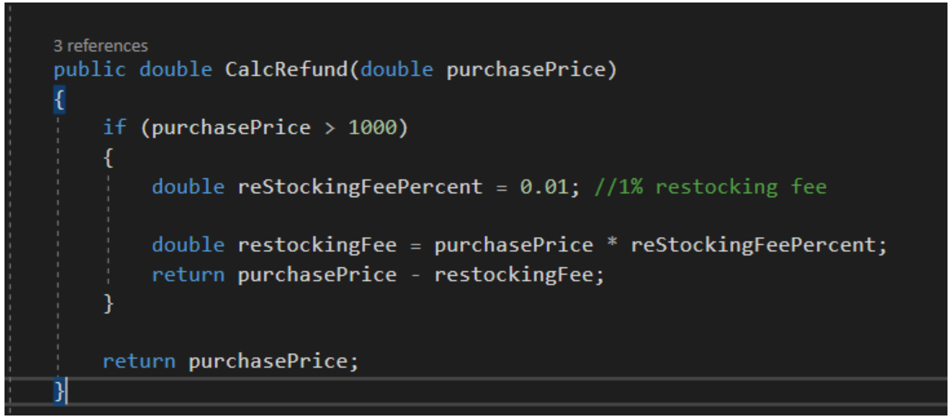


What is a Unit Test?

Unit Test: An **automated test** that exercises an **isolated chunk of code** passing in various input and **validating the outputs**.

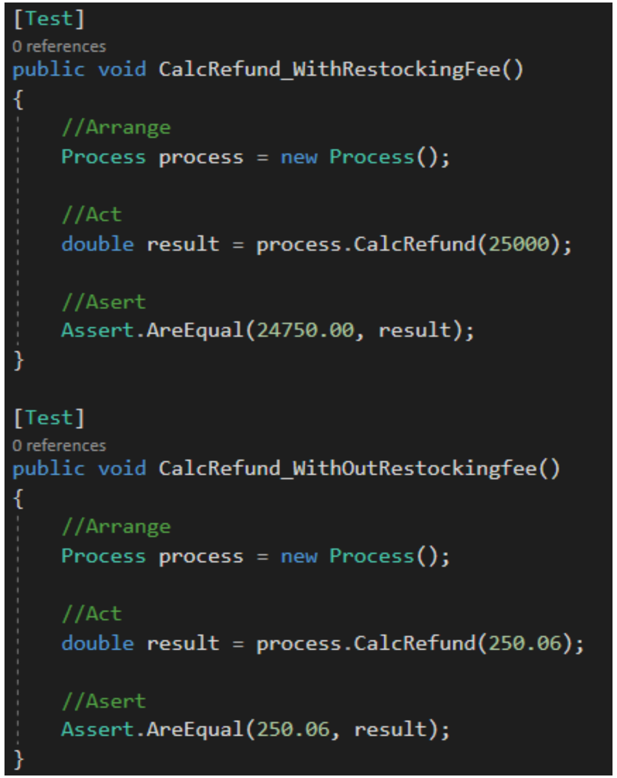
Example

The Code



```
3 references
public double CalcRefund(double purchasePrice)
{
    if (purchasePrice > 1000)
    {
        double reStockingFeePercent = 0.01; //1% restocking fee

        double restockingFee = purchasePrice * reStockingFeePercent;
        return purchasePrice - restockingFee;
    }

    return purchasePrice;
}
```

The Tests



```
[Test]
0 references
public void CalcRefund_WithRestockingFee()
{
    //Arrange
    Process process = new Process();

    //Act
    double result = process.CalcRefund(25000);

    //Asert
    Assert.AreEqual(24750.00, result);
}

[Test]
0 references
public void CalcRefund_WithOutRestockingfee()
{
    //Arrange
    Process process = new Process();

    //Act
    double result = process.CalcRefund(250.06);

    //Asert
    Assert.AreEqual(250.06, result);
}
```

What is a unit? … It depends on your goal

1

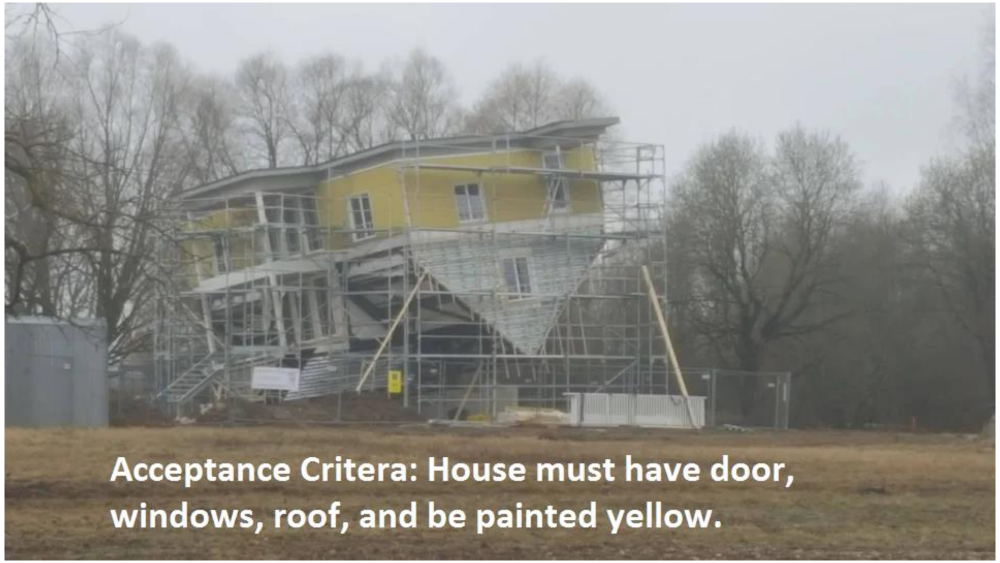
A specific function inside a process

- Example BuildName, from Simple Web site
- *Functions Goal: Takes the pieces of a name: First Name, Last Name, Middle, ect. name and builds a formatted name string*

2

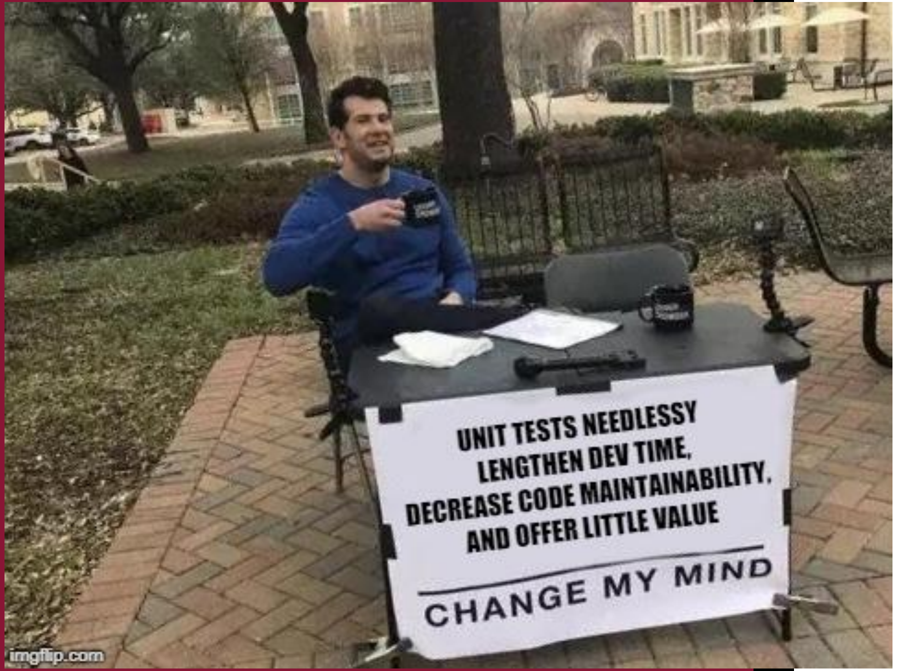
The output of a process

- Example BuildFeedingHistory in for API
- *Functions Goal: Take the output of a single Query statement and build a specifically formatted Json object*



Acceptance Critera: House must have door, windows, roof, and be painted yellow.

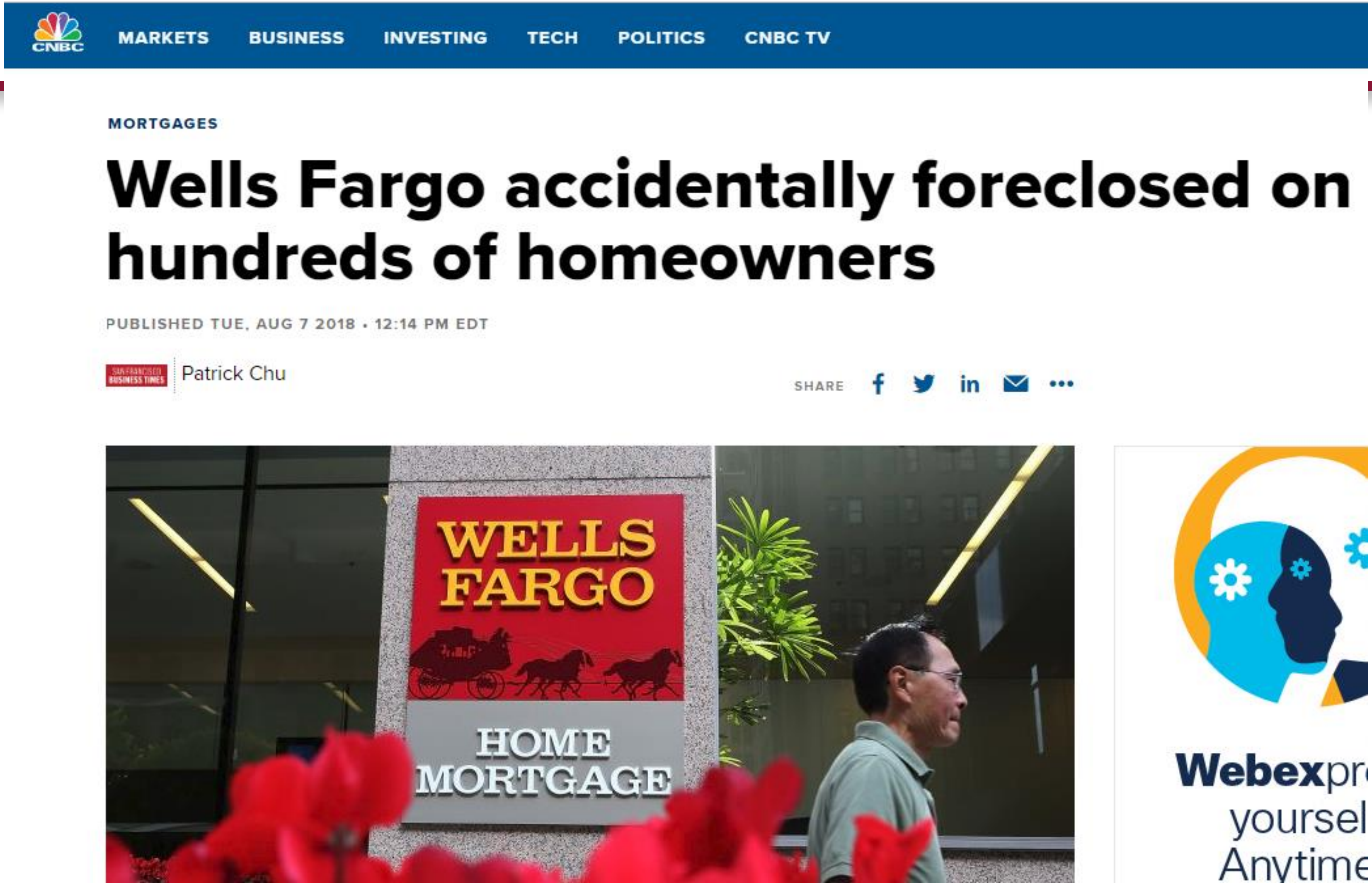
WHY



Why spend the time?

To increase the Quality of our software.

Isn’t that enough?

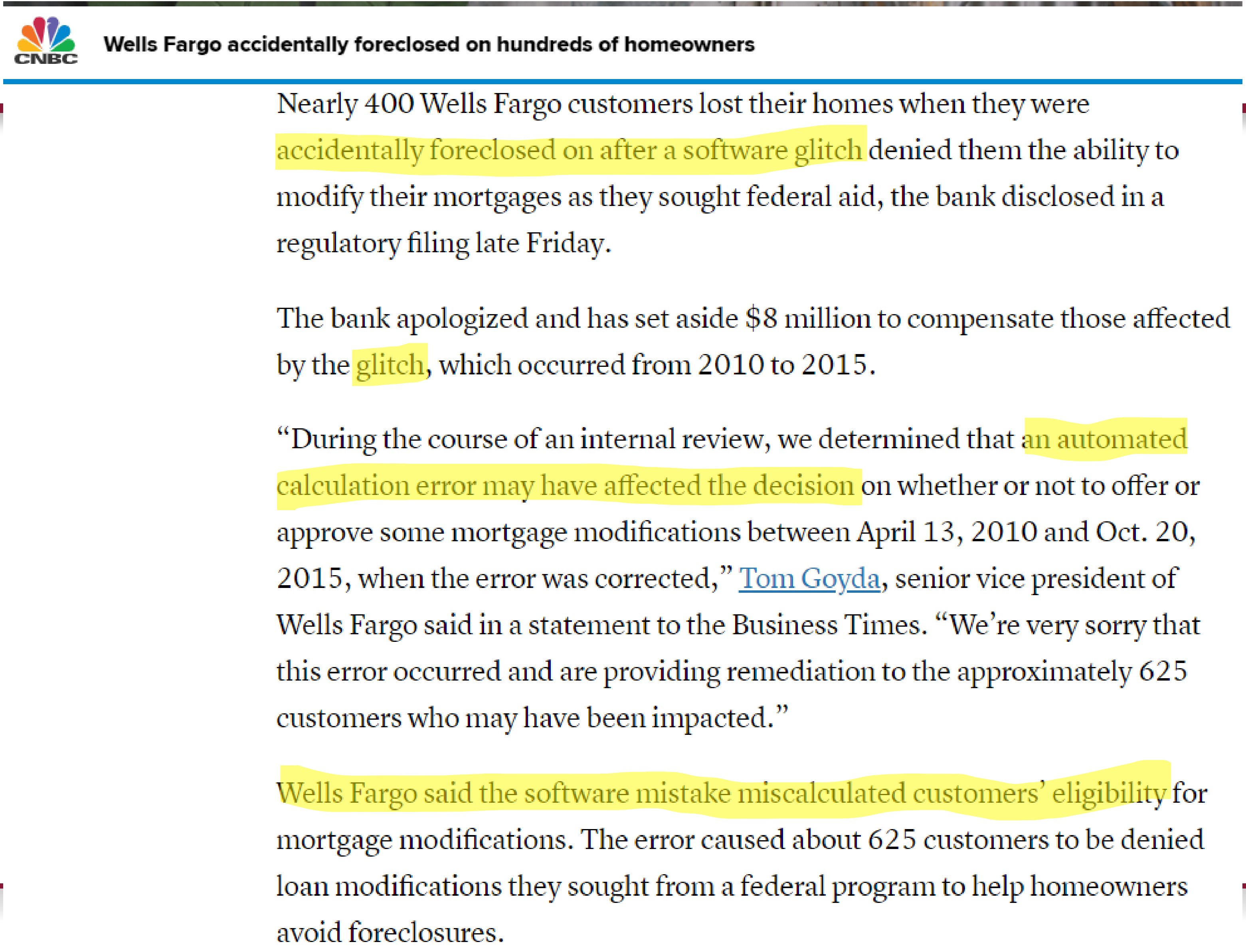


MORTGAGES

Wells Fargo accidentally foreclosed on hundreds of homeowners

PUBLISHED TUE, AUG 7 2018 • 12:14 PM EDT

SAN FRANCISCO BUSINESS TIMES Patrick Chu



Wells Fargo accidentally foreclosed on hundreds of homeowners

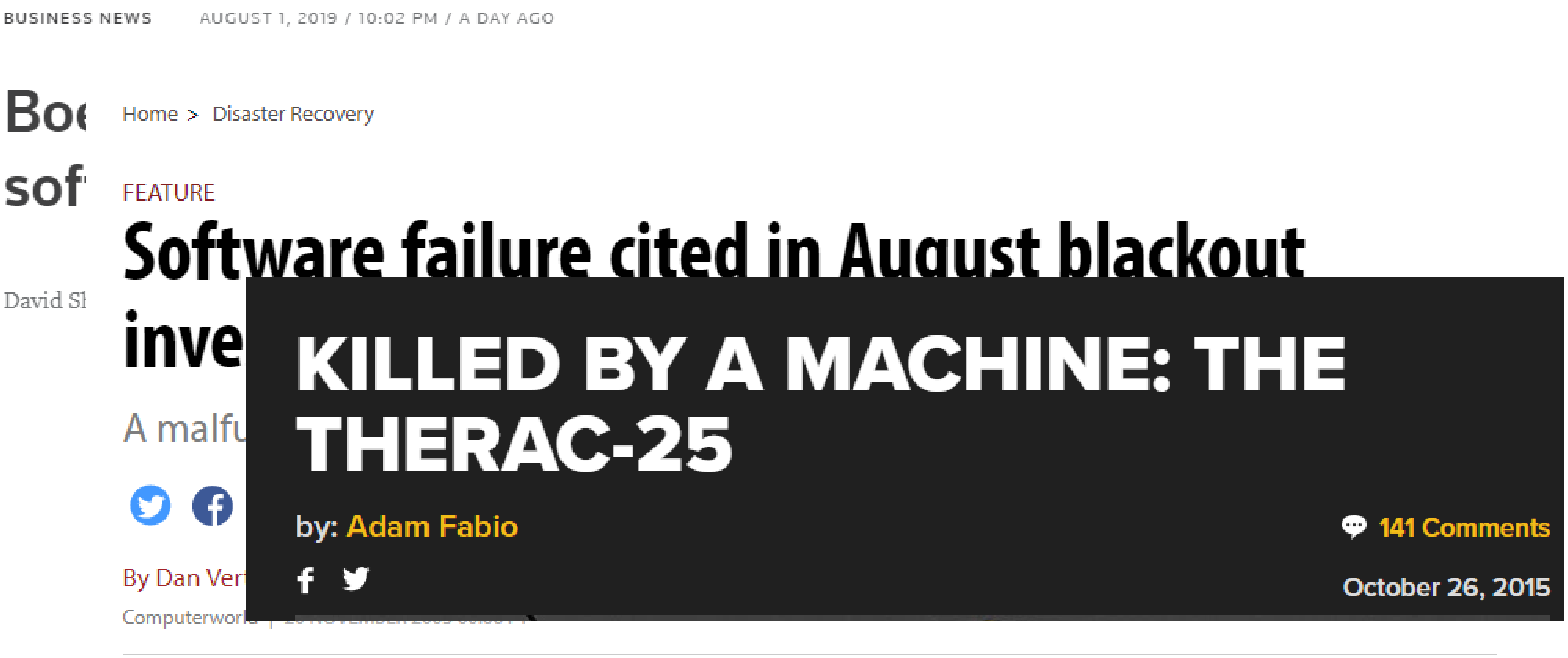
Nearly 400 Wells Fargo customers lost their homes when they were accidentally foreclosed on after a software glitch denied them the ability to modify their mortgages as they sought federal aid, the bank disclosed in a regulatory filing late Friday.

The bank apologized and has set aside $8 million to compensate those affected by the glitch, which occurred from 2010 to 2015.

"During the course of an internal review, we determined that an automated calculation error may have affected the decision on whether or not to offer or approve some mortgage modifications between April 13, 2010 and Oct. 20, 2015, when the error was corrected," Tom Goyda, senior vice president of Wells Fargo said in a statement to the Business Times. "We're very sorry that this error occurred and are providing remediation to the approximately 625 customers who may have been impacted."

Wells Fargo said the software mistake miscalculated customers' eligibility for mortgage modifications. The error caused about 625 customers to be denied loan modifications they sought from a federal program to help homeowners avoid foreclosures.

Not an anomaly, cases like these are all over the news



BUSINESS NEWS AUGUST 1, 2019 / 10:02 PM / A DAY AGO

Boe

sof

David Sl

Home > Disaster Recovery

FEATURE

Software failure cited in August blackout inve

A malfu

By Dan Ver

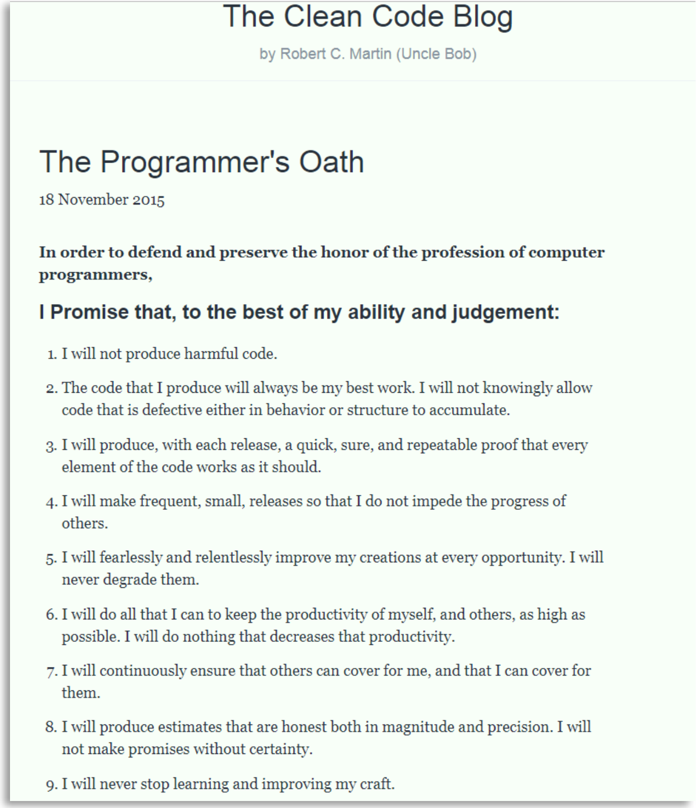
Computerworld |

KILLED BY A MACHINE: THE THERAC-25

by: Adam Fabio

141 Comments

October 26, 2015



The Clean Code Blog

by Robert C. Martin (Uncle Bob)

The Programmer's Oath

18 November 2015

In order to defend and preserve the honor of the profession of computer programmers,

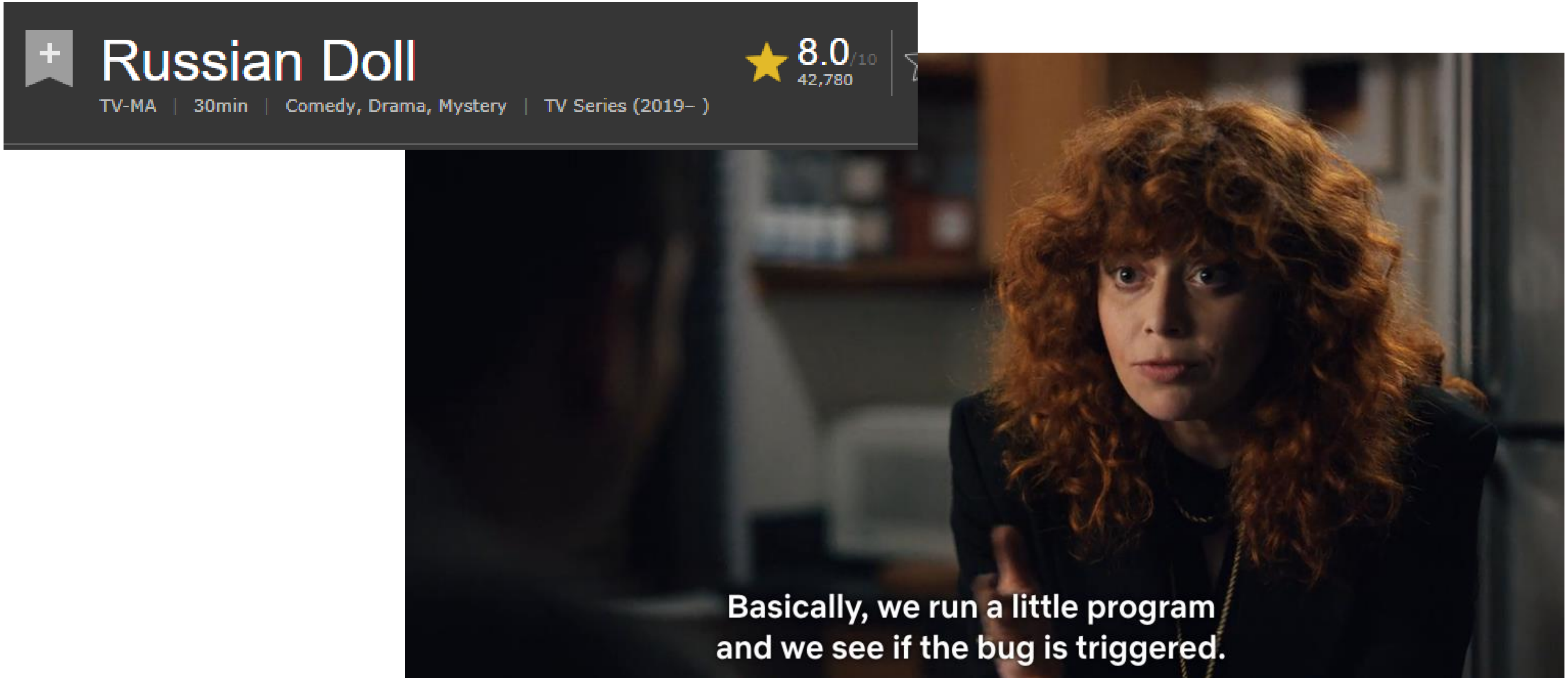
I Promise that, to the best of my ability and judgement:

1. I will not produce harmful code.
2. The code that I produce will always be my best work. I will not knowingly allow code that is defective either in behavior or structure to accumulate.
3. I will produce, with each release, a quick, sure, and repeatable proof that every element of the code works as it should.
4. I will make frequent, small, releases so that I do not impede the progress of others.
5. I will fearlessly and relentlessly improve my creations at every opportunity. I will never degrade them.
6. I will do all that I can to keep the productivity of myself, and others, as high as possible. I will do nothing that decreases that productivity.
7. I will continuously ensure that others can cover for me, and that I can cover for them.
8. I will produce estimates that are honest both in magnitude and precision. I will not make promises without certainty.
9. I will never stop learning and improving my craft.

THE FUTURE OF SOFTWARE

#3 I will produce, with each release, a quick, sure, and repeatable proof that every element of the code works as it should

Unit Test in the Mainstream



Russian Doll

★ 8.0/10
42,780

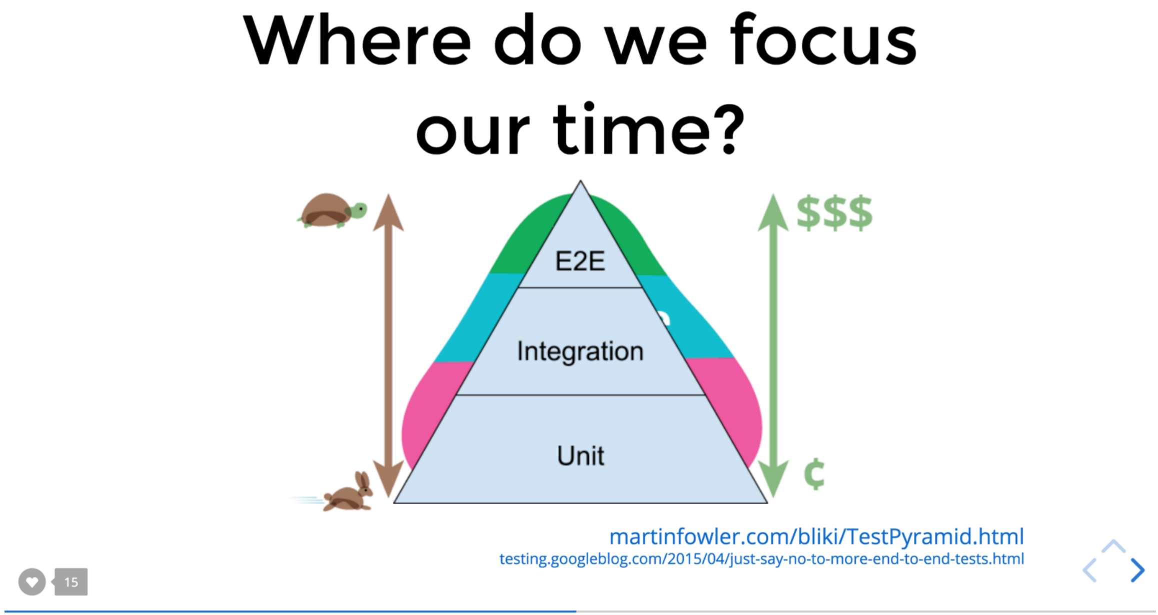
TV-MA | 30min | Comedy, Drama, Mystery | TV Series (2019–)

Basically, we run a little program
and we see if the bug is triggered.

BACK IN MY DAY
TESTING IS WHAT YOU DID ON A VERY LONG WEEKEND BEFORE RELEASE
imgflip.com

IS UNIT TESTING ALWAYS WORTH IT? .... NO

Unit tests take time to write and maintain, its not always the best use of resources.



Where do we focus our time?

martinfowler.com/bliki/TestPyramid.html

testing.googleblog.com/2015/04/just-say-no-to-more-end-to-end-tests.html

DECIDE WHERE TO SPEND YOUR TIME

How to Decide to write unit tests?

Write Unit Tests to:

Write better code

Protect your code

Document your code

Understand existing code

Don’t write unit test to:

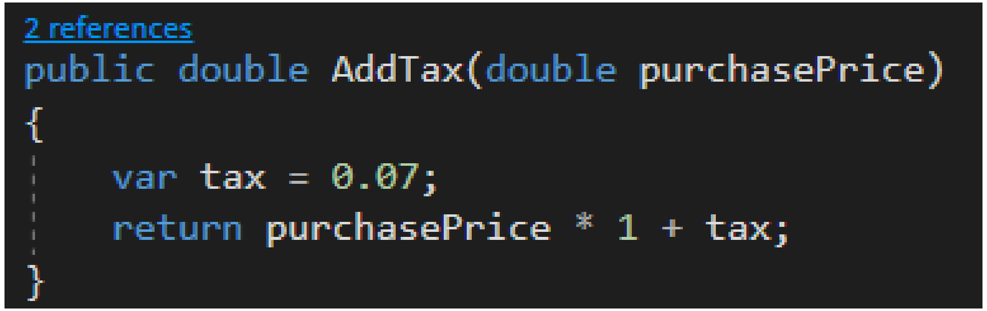
Reach a code coverage metric

Because someone told you it was what a good developer always does

Testing code that doesn't do anything interesting

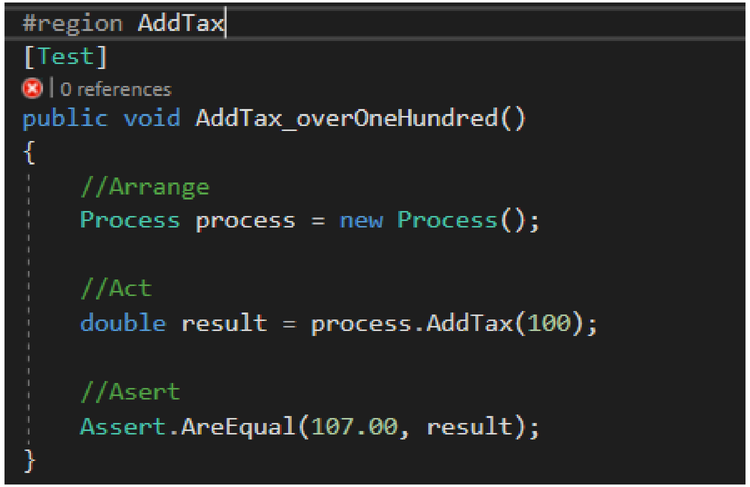
Write Better Code

Start with



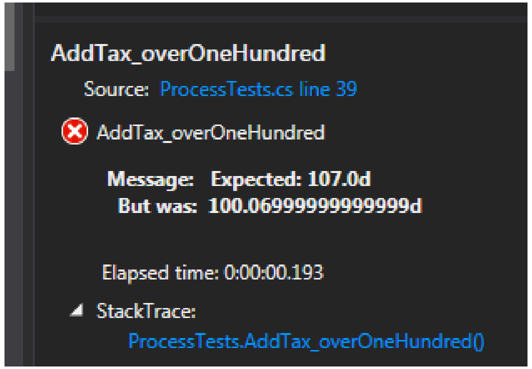
```
2 references
public double AddTax(double purchasePrice)
{
    var tax = 0.07;
    return purchasePrice * 1 + tax;
}
```

Write Test



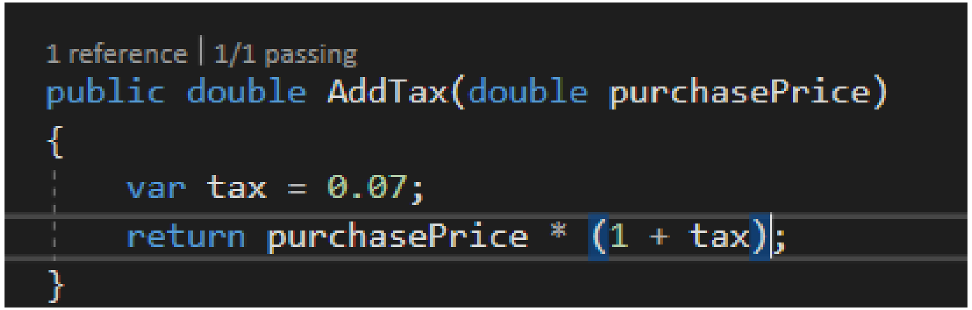
```
#region AddTax
[Test]
| 0 references
public void AddTax_overOneHundred()
{
    //Arrange
    Process process = new Process();

    //Act
    double result = process.AddTax(100);

    //Asert
    Assert.AreEqual(107.00, result);
}
```

Test Fails



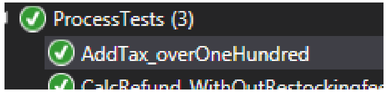
```
AddTax_overOneHundred
  Source:  ProcessTests.cs line 39

  AddTax_overOneHundred

    Message:   Expected: 107.0d
      But was:  100.06999999999999d

    Elapsed time: 0:00:00.193
  ◢ StackTrace:
        ProcessTests.AddTax_overOneHundred()
```

Whoops!



```
1 reference | 1/1 passing
public double AddTax(double purchasePrice)
{
    var tax = 0.07;
    return purchasePrice * (1 + tax);
}
```

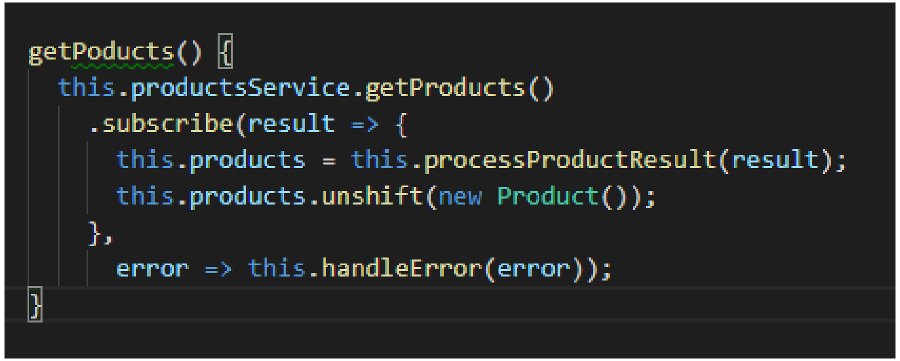
Test Passes!



```
✓ ProcessTests (3)
    ✓ AddTax_overOneHundred
    ✓ CalcRefund_WithOutRestockingfe
```

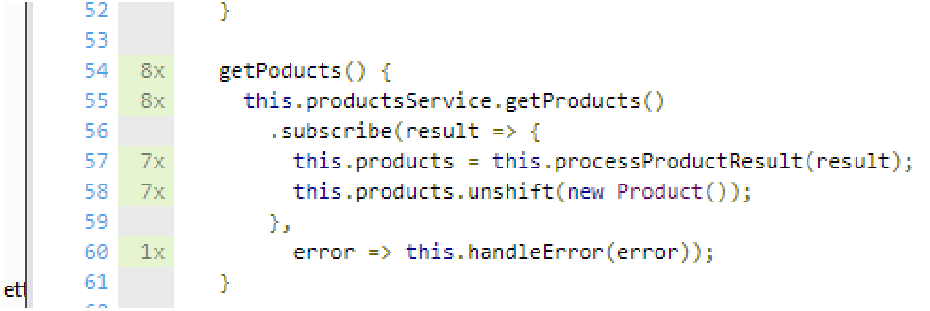
Misleading code coverage

Example Code Chunk



```
getPoducts() {
  this.productsService.getProducts()
    .subscribe(result => {
      this.products = this.processProductResult(result);
      this.products.unshift(new Product());
    },
      error => this.handleError(error));
}
```

Code coverage says that I hit this method, in fact it says I hit 7 times! Go



```
        }

  8x    getPoducts() {
  8x      this.productsService.getProducts()
            .subscribe(result => {
  7x          this.products = this.processProductResult(result);
  7x          this.products.unshift(new Product());
            },
  1x          error => this.handleError(error));
        }
```

Remove the unshift line and my tests still all pass, huh???

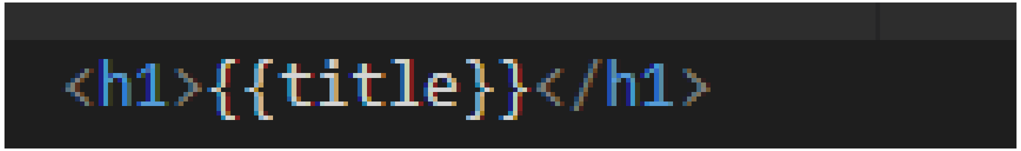
This method does two things

1. Go get the products via the service
2. Add an empty product to the top of the list

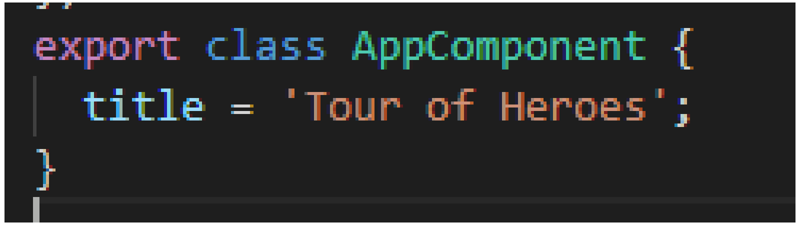
7 tests checked on different ways that the products got set and therefore passed through the unshift line, but no test actually verified the empty product was there at the top. Therefore if that line where to be removed or changed we would not catch it in a unit test.

Don’t Test Uninteresting Code

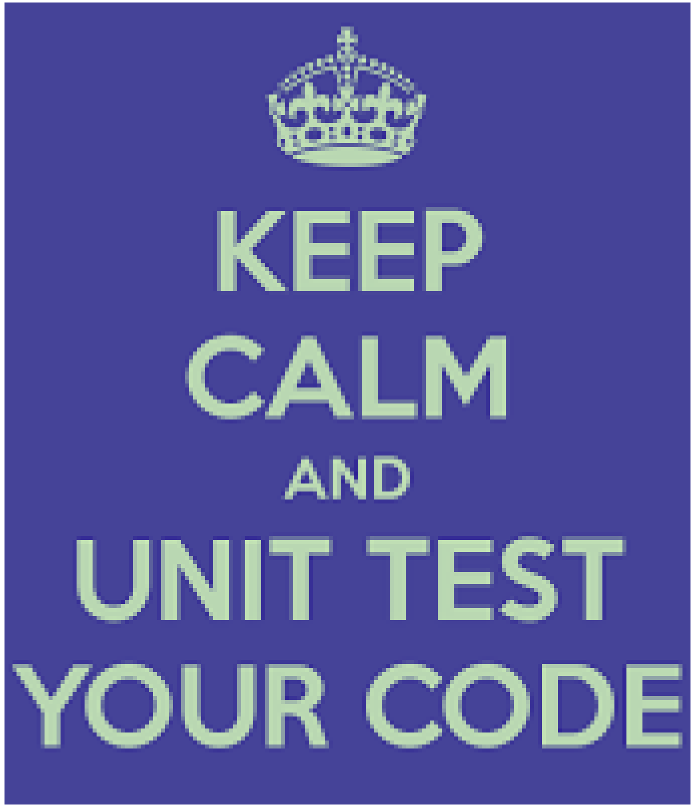
- Don’t test code that doesn't do anything interesting. Like a test that tests that the Title is set to a string that is hard coded with no logic



```
<h1>{{title}}</h1>
```



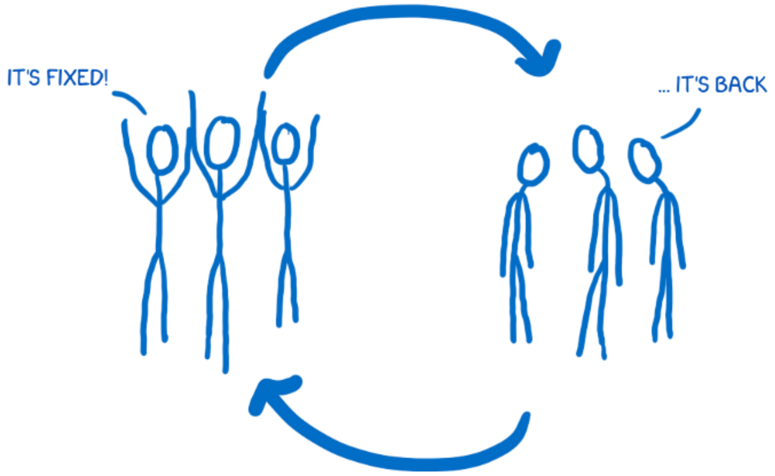
```
export class AppComponent {
  title = 'Tour of Heroes';
}
```



WHEN

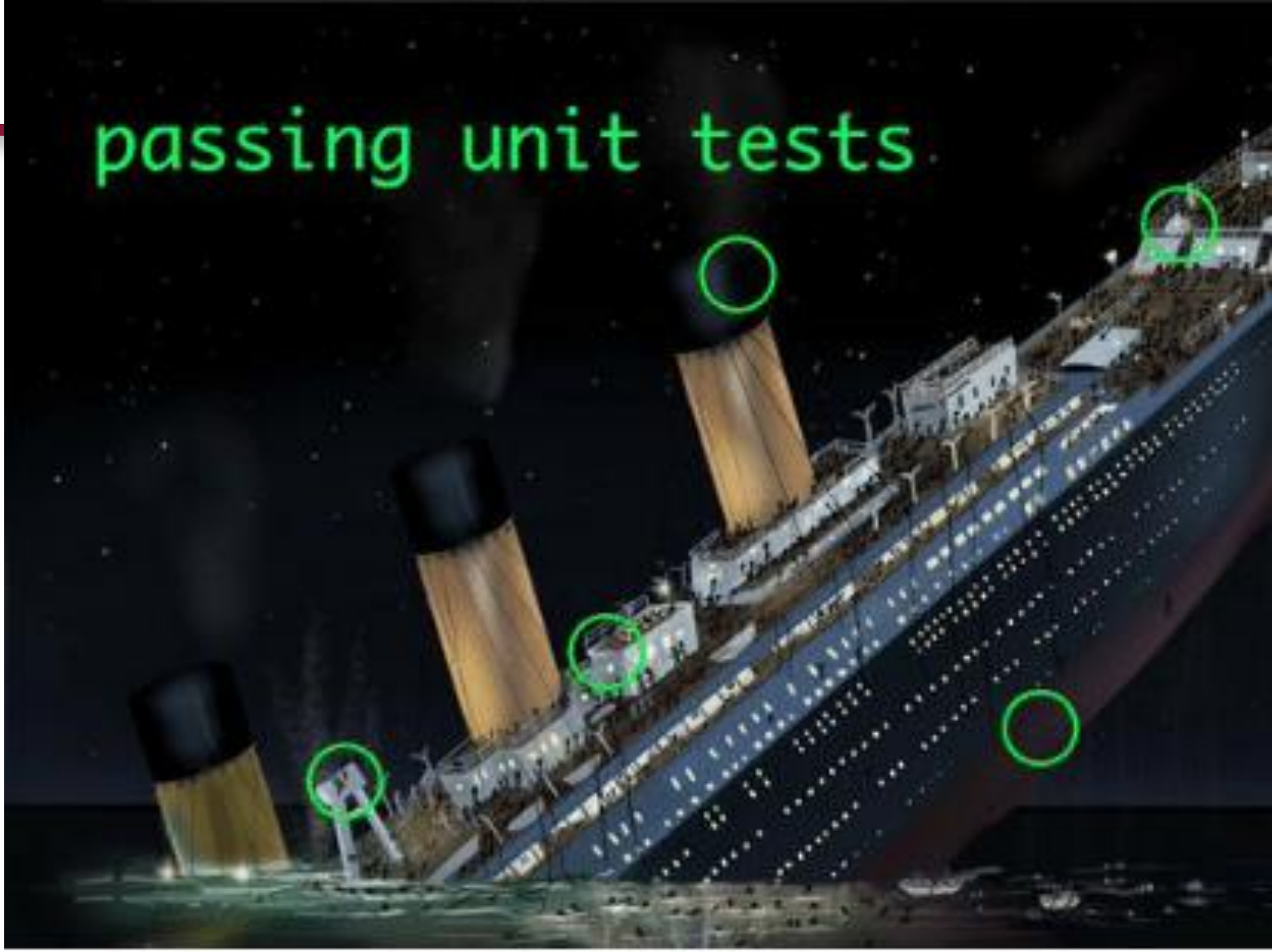
When should I write Unit Test

- If you’re creating a brand new project. Start out on the right foot and add a unit test project to the solution
- When your adding new functionality
- When you’re fixing a bug. So you never have to fix it again



WHO

HOW



Hits too close to home

Writing Good Tests

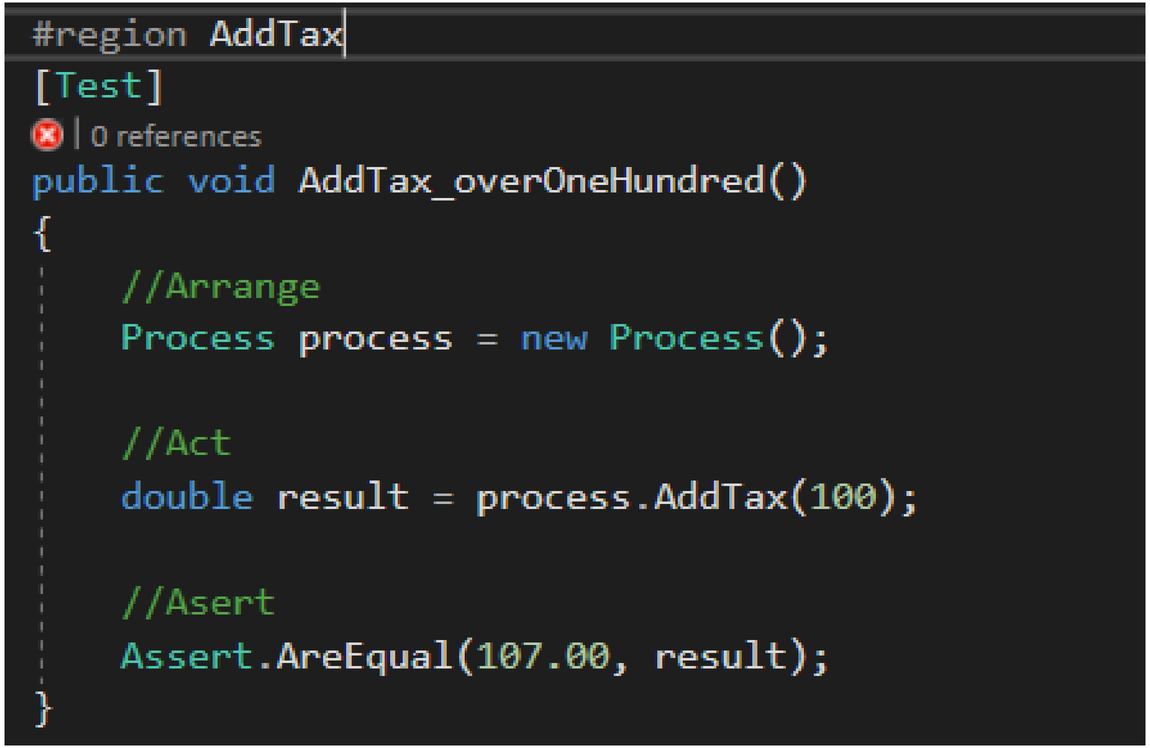
A GOOD TEST IS….

- Is self-contained (tests run in any order)
- Cleans up after itself
- Has a clear name with a clear goal
- Tells its own story

“unit tests will enable you to refactor fearlessly” – Mark Seeman Pluralsight course: Advanced Unit Testing

Techniques

- AAA pattern
- Damp vrs Dry
- Mocking



```
#region AddTax
[Test]
⊗ | 0 references
public void AddTax_overOneHundred()
{
    //Arrange
    Process process = new Process();

    //Act
    double result = process.AddTax(100);

    //Asert
    Assert.AreEqual(107.00, result);
}
```

AAA Pattern

- **ARRANGE**: setup needed for the test
- **ACT**: call the code under test
- **ASSERT**: test the results of the method

Good Tests Tell a Story

- DRY : don’t repeat yourself
- DAMP: descriptive and meaningful phrases
  - Repeat yourself if necessary

MOCKING

Dependency Injecting is good in general, but essential in unit testing.

What’s Next

Next Steps

- Review your Definition of Done and add a Unit testing commitment to it.
- Review the Developers Oath proposed by Bob Martin. Good unit tests can go along way to supporting many or the promises in the oath.
- Learn as much as you can about what ever sparks your curiosity.

Resources

- Pluralsight courses
  - My current fav [Angular]: Unit Testing in Angular
- Blogs
- Co-workers

What I hope you take away…

- A Good Test Makes for Better Code
- Writing unit tests is almost always worth it

Contact Info

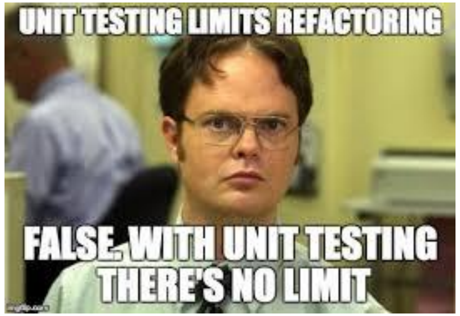
Elizabeth Groom

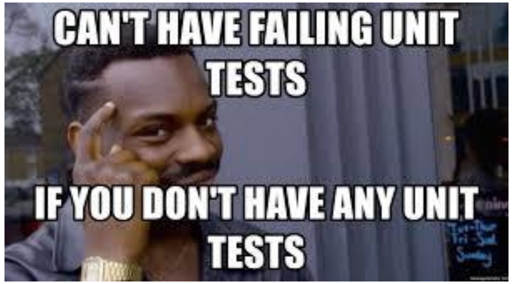
@ElizabethAGroom

Slides and Code:

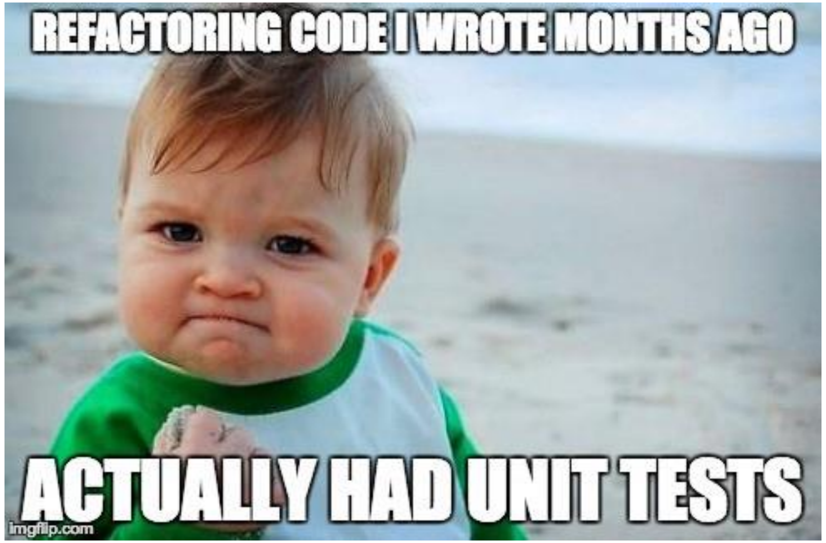
Q&A

Favorite other memes found


UNIT TESTING LIMITS REFACTORING
FALSE. WITH UNIT TESTING THERE'S NO LIMIT
imgflip.com


CAN'T HAVE FAILING UNIT TESTS
IF YOU DON'T HAVE ANY UNIT TESTS

I SEE YOU TEST YOUR CODE IN PRODUCTION
I TOO LIKE TO LIVE DANGEROUSLY



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SEE YOU NEXT YEAR!

AUGUST 4 - 6, 2020

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