Testing in JavaScript with Mocha and Chai

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“There are two ways to write error-free programs; only the third one works.”

Alan J. Perlis

Index

Software Testing

- Definition
- Importance
- Types
- Testing Pyramid

Methodology

- Priori
- Posteriori

Index

Suppose that we want to check if this function works correctly...

```
function isPrime(n) {
 for (let i = 2; i < n; i++) {
   if (n % i === 0) {
     return false;
   }
 }
 return true;
}
```

- What guarantee do we have that it works for **any** number I give it as input?
- And if af I give it a negative number?
- Numbers are infinite.
- We **can't** check all the numbers, it's **impossible**.

What is Software Testing?

*Activity to check whether the actual results match the expected results and to ensure that the software system is defect **free**.*

Bug #415

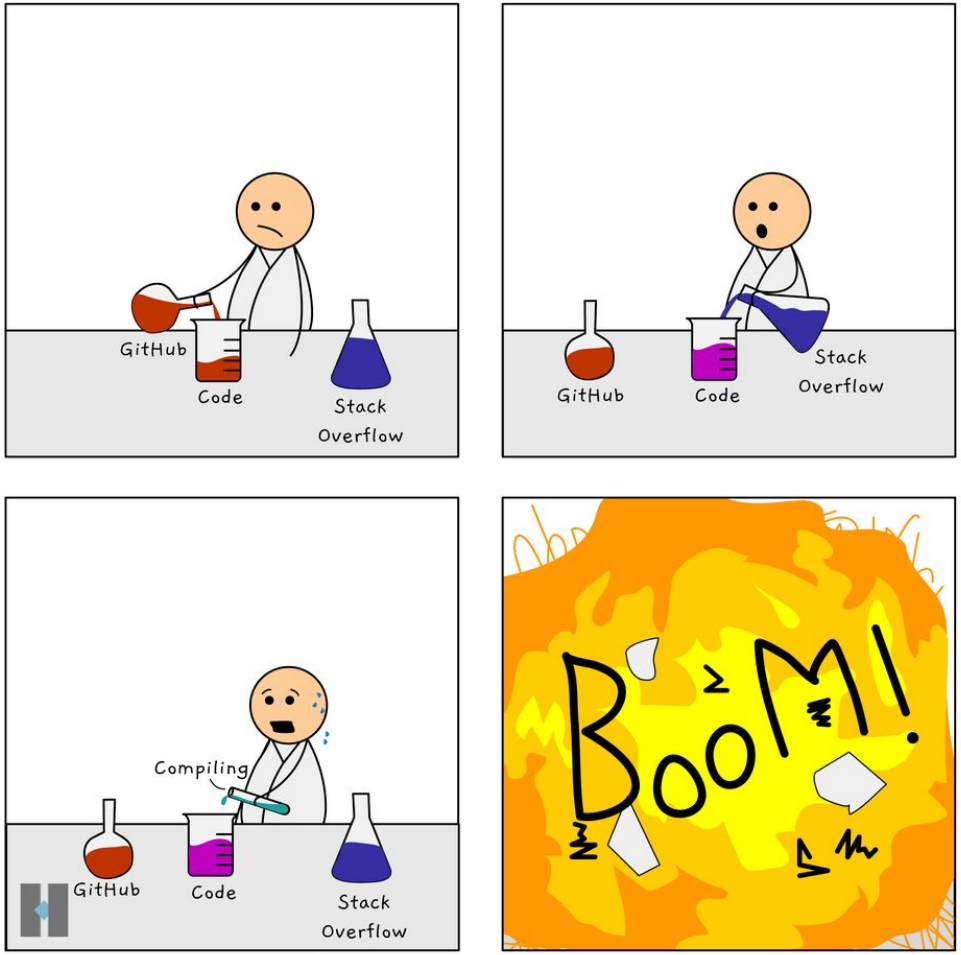
Bug #416

Bug #417

Bug #418

Bug #419

Bug #420



Why is Software Testing Important?

MONEY

DANGER

History Examples

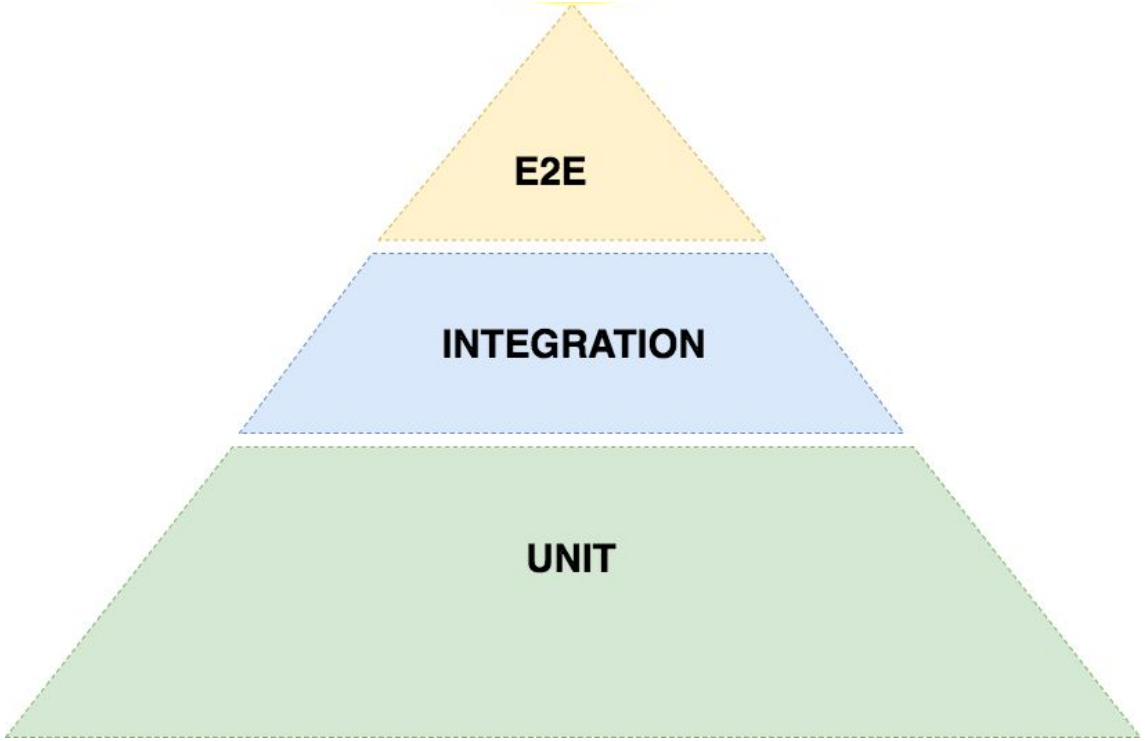
- In may of 1996, a software bug caused the bank accounts of 823 customers of a major U.S. bank to be credited with **920 million US dollars**.

- In 1985, Canada's Therac-25 radiation therapy machine malfunctioned due to software bug and delivered lethal radiation doses to patients, leaving **3 people dead** and critically injuring 3 others.

Testing types

Functional Testing	Non-Functional Testing	Maintenance
Test each function providing appropriate input and verifying the output against the Functional requirements.	Checks non-functional aspects such as performance, usability, reliability, etc, of software application.	Maintenance of the software and correcting errors that may occur during its use.

Testing Pyramid



Testing Pyramid

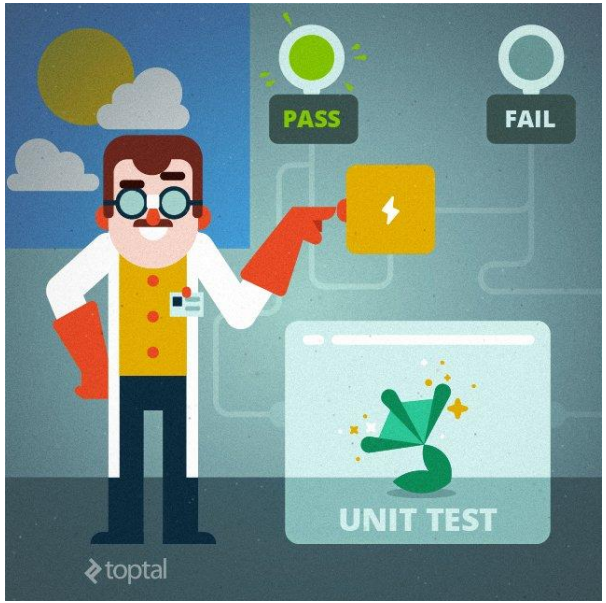
Unit tests: Test individual units of code in isolation.

Integration tests: Test the integrations between different units.

E2E: Test the system as a whole, from the UI down to the data store, and back.

Methodology

- Posteriori
- Priori



Unit Test a Posteriori

It consists of the following steps

1. Write a functionality code
2. Write and run test

Unit Test a Posteriori

It is a structured and automated way to prove this

```
const add = function(valueOne, valueTwo) {
    const suma = valueOne + valueTwo;
    return suma;
};
```

Unit Test a Posteriori

It is a structured and automated way to prove this

```
const add = function(valueOne, valueTwo) {
   const suma = valueOne + valueTwo;
   return suma;
};

if (add(1, 2) !== 3) {
   throw new Error('Failed');
}
```

TDD: Unit Test a Priori

Test-driven development is mostly a <u>loop</u> of the following steps:

1. Write test
2. Run test... **Fail**
3. Write a minimum amount of code for the test to work
4. Run test... **Pass**

TDD: Unit Test a Priori

```
if (add(1, 2) !== 3) {
   throw new Error('Failed');
}
```

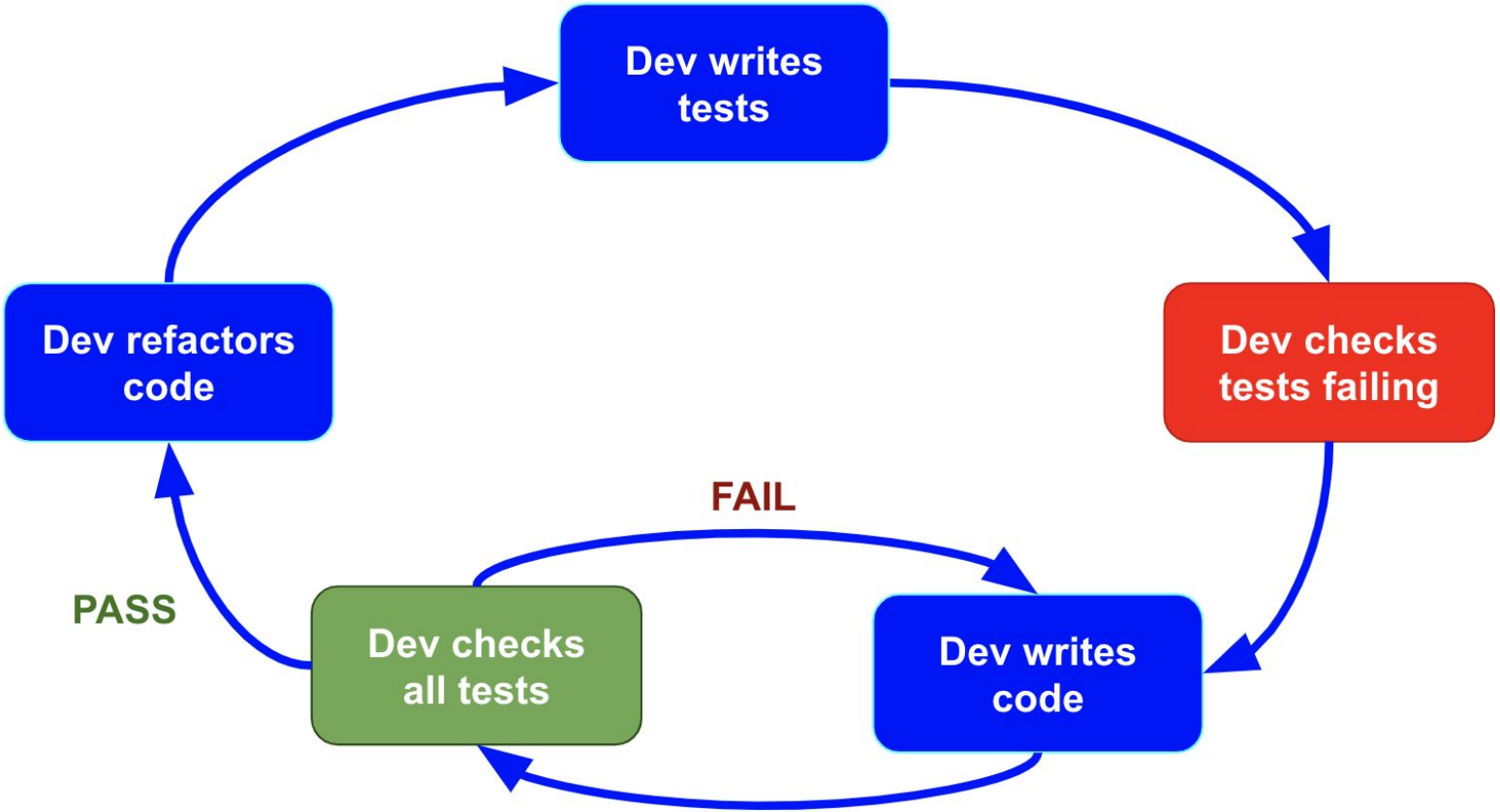
TDD: Unit Test a Priori

```
const add = function(valueOne, valueTwo) {
    return 3;
};


if (add(1, 2) !== 3) {
    throw new Error('Failed');
}
```

TDD: Unit Test a Priori

```
const add = function(valueOne, valueTwo) {
    const suma = valueOne + valueTwo;
    return suma;
};
```


Dev writes tests
Dev checks tests failing
Dev writes code
Dev checks all tests
Dev refactors code
FAIL
PASS

Popular Testing Frameworks for JavaScript

Jest

Mocha and Chai

Mocha:

- JS Framework.
- Runs on Node.js and browsers.
- **Allows**:
  - Asynchronous testing.
  - Test coverage reports.
  - Use of any assertion library.

Mocha and Chai

Chai:

- BDD / TDD assertion library for Node.js and Browsers
- It has several interfaces:
  - assert
  - expect
  - should

Mocha and Chai

Chai:

```
const EXAMPLE = 'matchByMatch';

assert.equal(EXAMPLE, 'matchByMatch');
expect(EXAMPLE).to.equal('matchByMatch');
EXAMPLE.should.equal('matchByMatch');
```

Although it has a different structure the same results are obtained.

Mocha and Chai installation

To test code in the browser run on terminal:

```
npm install mocha chai --save-dev
```

To test Node.js code, in addition to the above, run:

```
npm install -g mocha
```

How can I test?

The structure of the unit tests is formed by **6** different elements:

1. **describe**
2. **it**
3. **before**
4. **beforeEach**
5. **after**
6. **afterEach**

How can I test?

1. **describe:** It's used to group, which you can nest as deep
2. **it:** It's the test case

Receive two parameters: A message and a function

```
describe('<message>', function() {});

it('<message>', () => {});
```

How can I test?

Scenario: **One test case**

```
it('It works on my machine', () => {
  /** Test cases */
});
```

How can I test?

Scenario: **A nested test case**

```
describe('Historical phrases', () => {
  describe('Computer engineering', () => {
    it('It works on my machine', () => {
      /** Test cases */
    });
  });
});
```

How can I test?

Scenario: **Two test cases in one test**

```
describe('Historical phrases', () => {
  it('It works on my machine', () => {
    /** Test cases */
  });
  it('Match By Match', () => {
    /** Test cases */
  });
});
```

How can I test?

3. **before**: It's a code to run before the *first* it()
4. **beforeEach**: It’s a code to run *before each* it()
5. **after**: It’s a code to run *after* it()
6. **afterEach**: It’s a code to run *after each* it()

How can I test?

```
describe('Description', () => {
  beforeEach(() => {
    console.log('Random message');
  });

  it('Test # 1', () => {});
  it('Test # 2', () => {});
});
```

How can I test?

A)

Random message

✓ Test # 1

Random message

✓ Test # 2

B)

Random message

Random message

✓ Test # 1

✓ Test # 2

C)

Random message

✓ Test # 1

✓ Test # 2

How can I test?

A)

Random message

✓ **Test # 1**

Random message

✓ **Test # 2**

B)

Random message

Random message

✓ Test # 1

✓ Test # 2

C)

Random message

✓ Test # 1

✓ Test # 2

Define “it”

```
const assert = require('chai').assert;

const add = function(valueOne, valueTwo) {
  const suma = valueOne + valueTwo;
  return suma;
};

it('add test', function() {
  assert.equal(add(2, 3), 5);
});
```

Define “it”

```
const assert = require('chai').assert;

const add = function(valueOne, valueTwo) {
  const suma = valueOne + valueTwo;
  return suma;
};

it('add test', function() {
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Define “it”

```
const assert = require('chai').assert;

const add = function(valueOne, valueTwo) {
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```

Define “it”

```
const assert = require('chai').assert;

const add = function(valueOne, valueTwo) {
  const suma = valueOne + valueTwo;
  return suma;
};

it('add test', function() {
  assert.equal(add(2, 3), 5);
});
```

Directory Structure

Source code → **/src/** program.js

Evidence Code → **/test/** program_test.js

Directory Structure

../src/add.js

```
exports.add = function(valueOne, valueTwo) {
    const suma = valueOne + valueTwo;
    return suma;
};
```

Directory Structure

../test/add_test.js

```
const assert = require('chai').assert;
const {add} = require('../src/add');

it('add test', function() {
  assert.equal(add(2, 3), 5);
});
```

Test Runner

- With **Mocha** and **Chai** it is possible to run the tests both in **Node.js** and in **browsers**.

- But there are some differences in the way to do it...

How to run tests in browsers?

Very important:

It’s necessary a *.html* file to run the tests.

```html
<!DOCTYPE html>
<html>
 <head>
   <title>Mocha Tests</title>
   <link rel="stylesheet" href="../node_modules/mocha/mocha.css" />
 </head>
 <body>
   <div id="mocha"></div>
   <script src="../node_modules/mocha/mocha.js"></script>
   <script src="../node_modules/chai/chai.js"></script>
   <script>
     mocha.setup("bdd");
   </script>

   <!-- load code you want to test here -->
   <script src="src/add.js"></script>

   <!-- load your test files here -->
   <script src="test/add-browser-test.js"></script>

   <script>
     mocha.run();
   </script>
 </body>
</html>
```

How to run tests in node.js?

It is necessary to follow the following steps:

1. Create a working directory to develop the tests.
2. Change to that directory.
3. Execute: `npm init` to initialize a new package.
4. Next, we run: `npm install` to install local dependencies.

How to run tests in node.js?

5. In the **package.json** file, we must change the "test" line to:

```
"test": "mocha"
```

6. Run the command:

```
npm test
```

How to run tests in node.js?

7. For run a specific file:

```
npm test <file path>
```

8. For run once and get continuous monitoring:

```
npm run test:watch
```

How to run tests in node.js?

Very important syntax tip:

In the file with the code to be tested, it is necessary to use the "**exports**" directive as shown on the next slide.

```
module.exports = {
 addClass: function(el, newClass) {
   if (el.className.indexOf(newClass) !==
-1) {
     return;
   }
   if (el.className !== "") {
     // Ensure class names are separated by
a space
     newClass = " " + newClass;
   }

   el.className += newClass;
 }
};
```

```
function addClass(el, newClass) {
 if (el.className.indexOf(newClass) !== -1)
{
   return;
 }

 if (el.className !== "") {
   // Ensure class names are separated by a
space
   newClass = " " + newClass;
 }

 el.className += newClass;
}
```

Exclusive Tests: Only

Execute only the block or the test case to which we add it.

```
it.only('If you can dream it, you can do it', () => {});
```

Exclusive Tests: Only

```
describe('Description', () => {
  it('Test # 1', () => {});
  it.only('Test # 2', () => {});
  it('Test # 3', () => {});
                .
                .
                .
  it('Test # n', () => {});
});
```

Exclusive Tests: Only

```
describe('Description', () => {
  it('Test # 1', () => {});
  it.only('Test # 2', () => {});
  it('Test # 3', () => {});
                .
                .
                .
  it('Test # n', () => {});
});
```

Inclusive Tests: Skip

Don’t execute the block or test case to which we add it.

```
it.skip('Think, believe, dream and dare', () => {});
```

Exclusive Tests: Skip

```
describe('Description', () => {
  it('Test # 1', () => {});
  it.skip('Test # 2', () => {});
  it('Test # 3', () => {});
                .
                .
                .
  it('Test # n', () => {});
});
```

Exclusive Tests: Skip

```
describe('Description', () => {
  it('Test # 1', () => {});
  it.skip('Test # 2', () => {});
  it('Test # 3', () => {});
                .
                .
                .
  it('Test # n', () => {});
});
```

Bad Practice

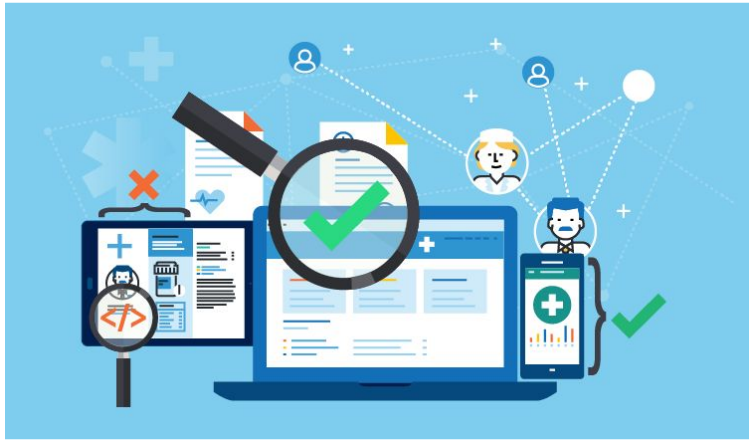
```
it('try absolutely everything', function() {
  assert.equal(add(2, 3), 5);
  assert.equal(sub(8, 2), 6);
  assert.equal(mult(4, 2), 8);
  assert.equal(div(10, 2), 5);
});
```

Good Practice

```
describe('Basic operations', () => {
  it.only('test add', function() {
    assert.equal(add(2, 3), 5);
  });
  it.only('test sub', function() {
    assert.equal(sub(8, 2), 6);
  });
});
```

Conclusion

It is **necessary** to use tests since it avoids problems and corrects functionality errors



We also make sure that each unit works properly as the product develops

Conclusion

Advantage:

- Identify errors in the development phase.
- Have a good quality software.
- We minimize maintenance and development costs
- We guarantee a software is reliable.

“There are two ways to write error-free programs; only the third one works.”

Alan J. Perlis

Bibliography

GitHub repository

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Thanks for your attention!

Any questions?

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