# (Proper) Object Oriented Programming and SOLID

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Inheritance
Class
Encapsulation
OOPS
Object
Abstraction
Polymorphism

# TEAM PRESENTATION

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## Before we start

- This is **not** a guide on how to do OOP in JS…
- …But, we'll touch on some basics.
- This is a guide on **good practices** of OOP (in JS).

## CONTENTS

# Object Oriented Programming In JS

## 1 Basics of OOP

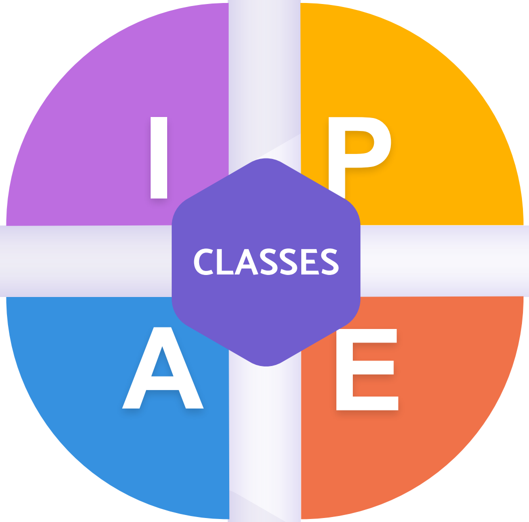
## Basics of OOP

**INHERITANCE**

basing a class off of another class so that it maintains the same behavior as its parent class

**POLYMORPHISM**

having the same interface to instances of different types



hiding the unnecessary implementation details from the users

**ABSTRACTION**

bundling data and methods that work on that data within one unit

**ENCAPSULATION**

# 2 OOP in JavaScript

## JS classes vs C++ classes

- JavaScript is not class based like C++.
- JS classes can be made with new/prototype (don't).
- JS classes can also be made with ES6 ***class*** keyword.
- In any case, JS classes are not like C++ classes.

## Class syntax

C++ Class:

```
class MyClass{
public:
   int atributo;
   MyClass() {
      atributo = 1;
   }

   int method() {...}
};
```

JavaScript Class:

```
class MyClass {
   constructor() {
      this.atributo = 1;
   }

   method() {...}
}
```

# Comparison with TypeScript

TypeScript Class:

```
class MyClass{
  atributo: number;
  MyClass() {
    this.atributo = 1;
  }

  method() {...}
};
```

JavaScript Class:

```
class MyClass {
  constructor() {
    this.atributo = 1;
  }

  method() {...}
}
```

## Differences to look out for

- Classes can be dynamically generated and updated (**Avoid this**)

- JS doesn’t implement protected access.
    - The convention is to finish protected properties with an underscore.

## Similarities

- Methods explicitly stop being iterable.
  (for-in loops work as intended)
- Static works the same way using the keyword **static**.
- Public and private access levels are quite similar.

## Access Levels

C++ Access Levels:

```
class MyClass {
  public int x;
  protected int y;
  private int z;
};
```

JavaScript Access Levels:

```
class MyClass {
  #z = …;
  constructor() {
    this.x = …;
    this.y_ = …; // kinda
    this.#z = …;
    // ! NOT INCOMPATIBLE
    // WITH (public) this.z
  }
}
```

## Comparison with TypeScript

TypeScript Access Levels:

```
class MyClass {
  x = …;
  protected y = …;
  private z = …;
};
```

JavaScript Access Levels:

```
class MyClass {
  #z = …;
  constructor() {
    this.x = …;
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}
```

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## Google Style Guide on JavaScript Classes

## Constructors and inheritance

- Constructors are optional.
- Subclass constructors must call **super()** before setting any fields or otherwise accessing **this**.
- Set all of a concrete object's fields in the constructor.

## Fields (naming, privacy, initialization)

- Class names in UpperCamelCase.
- Fields are all properties other than methods.
- End all **@protected** fields' names with an underscore.
- Annotate non-public fields with the proper visibility annotation (**@private**, **@protected**, **@constructor**).

## DO NOT touch the prototype

- Plain simple, don't define prototype properties.
- Why? Find out here!
- Also, don't use set/get
(They're weird)

## Static methods

- Prefer module-local functions over private static methods.
- Static methods should only be called on the base class itself. Avoid using them dynamically.
- **NEVER** call static methods on subclasses that don’t define them directly.

## Overriding ToString

- The **toString** method may be overridden,
- But must always succeed and **never have visible side effects.**

## Abstract classes and Interfaces

- Abstract classes and methods must be annotated with **@abstract.**

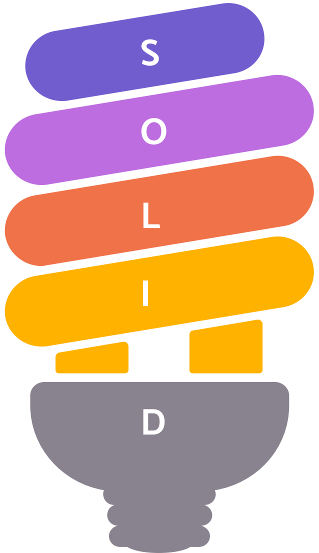
- Use them when appropriate.

## Computed Properties

- **Computed properties** may only be used in classes when the property is a symbol.
- A **[Symbol.iterator]** method should be defined for any classes that are logically iterable.
- Use symbols sparingly.

# Object Oriented Design in JS

(AKA How to detect, avoid and correct code smells)

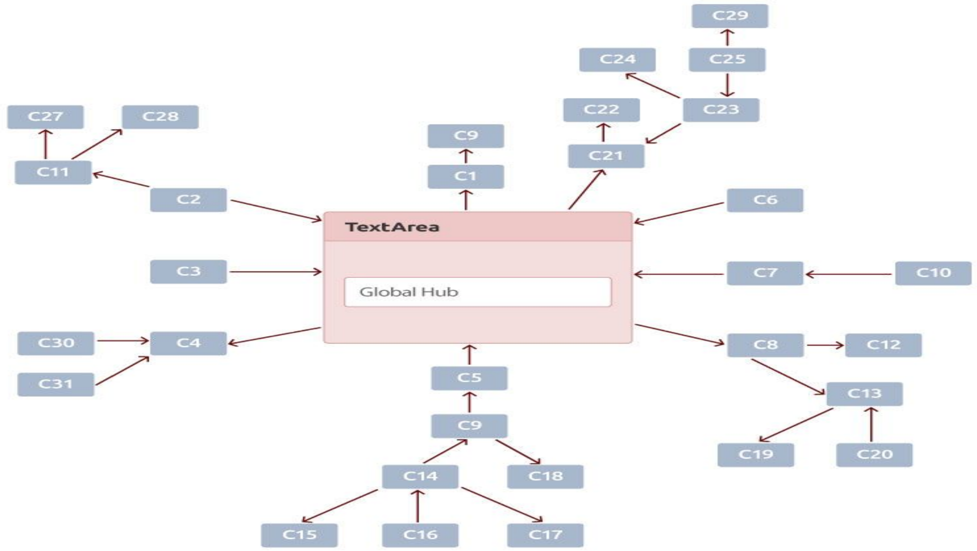


## Code Smells

- “A code smell is any characteristic in the code that hints at a deeper problem”

# Anti-patterns

- Counterpart of design patterns (AKA bad coding patterns).
- For example: The God Object



## Examples

- Is it **rigid**? (hard to update)
- Is it **fragile**? (does not handle errors too well)
- Is it too **compact**? (unable to modularize it)
- Is it **over-complex**? (has unused defined methods)
- Is it **opaque**? (hard to understand at first sight)
- Is it **mirror-like**? (tons of similar code)

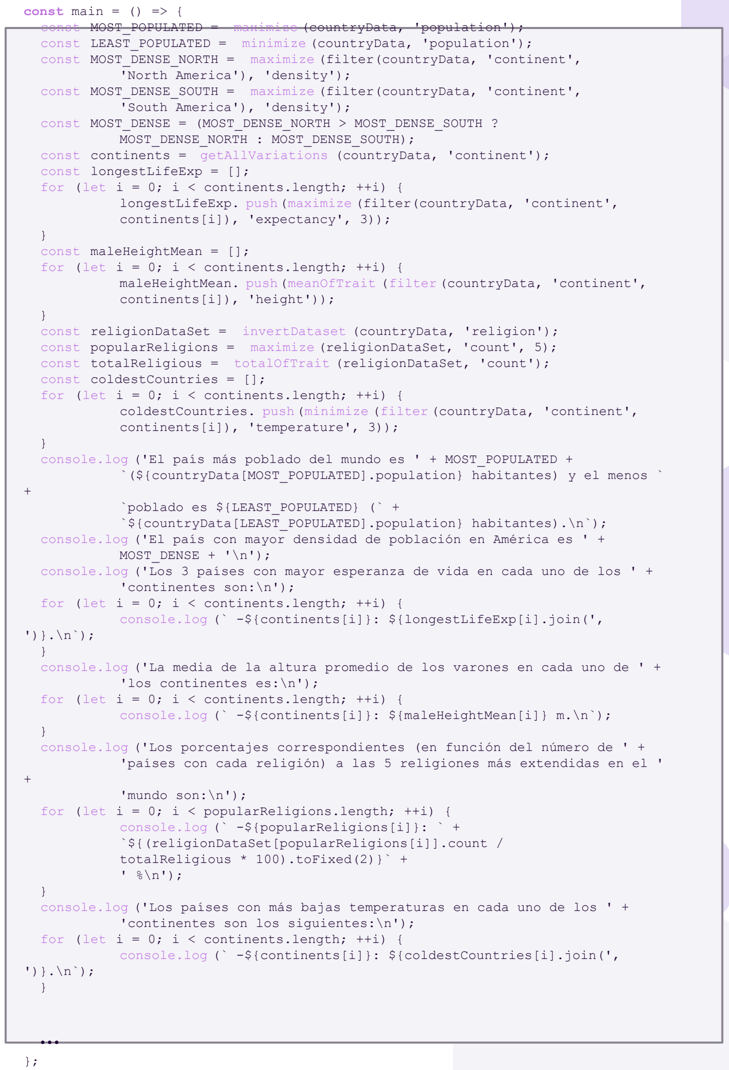
## Code smell

- Too many levels of indentation

```
function confusingFunction(arg) {
  for(const element of arg){
     if(arg !== 0){
       if(isOdd(arg){
          switch(arg) {
                ...
             }
          }
       }
    }
}
```

# Code smell

- Long functions (scrolling needed in order to read)



```
const main = () => {
  const MOST_POPULATED =  maximize (countryData, 'population');
  const LEAST_POPULATED =  minimize (countryData, 'population');
  const MOST_DENSE_NORTH =  maximize (filter(countryData, 'continent',
          'North America'), 'density');
  const MOST_DENSE_SOUTH =  maximize (filter(countryData, 'continent',
          'South America'), 'density');
  const MOST_DENSE = (MOST_DENSE_NORTH > MOST_DENSE_SOUTH ?
          MOST_DENSE_NORTH : MOST_DENSE_SOUTH);
  const continents =  getAllVariations (countryData, 'continent');
  const longestLifeExp = [];
  for (let i = 0; i < continents.length; ++i) {
          longestLifeExp. push(maximize (filter(countryData, 'continent',
          continents[i]), 'expectancy', 3));
  }
  const maleHeightMean = [];
  for (let i = 0; i < continents.length; ++i) {
          maleHeightMean. push(meanOfTrait (filter(countryData, 'continent',
          continents[i]), 'height'));
  }
  const religionDataSet =  invertDataset (countryData, 'religion');
  const popularReligions =  maximize(religionDataSet, 'count', 5);
  const totalReligious =  totalOfTrait (religionDataSet, 'count');
  const coldestCountries = [];
  for (let i = 0; i < continents.length; ++i) {
          coldestCountries. push(minimize(filter(countryData, 'continent',
          continents[i]), 'temperature', 3));
  }
  console.log ('El país más poblado del mundo es ' + MOST_POPULATED +
          `(${countryData[MOST_POPULATED].population} habitantes) y el menos `
+
          `poblado es ${LEAST_POPULATED} (` +
          `${countryData[LEAST_POPULATED].population} habitantes).\n`);
  console.log ('El país con mayor densidad de población en América es ' +
          MOST_DENSE + '\n');
  console.log ('Los 3 países con mayor esperanza de vida en cada uno de los ' +
          'continentes son:\n');
  for (let i = 0; i < continents.length; ++i) {
          console.log (` -${continents[i]}: ${longestLifeExp[i].join(',
')}.\n`);
  }
  console.log ('La media de la altura promedio de los varones en cada uno de ' +
          'los continentes es:\n');
  for (let i = 0; i < continents.length; ++i) {
          console.log (` -${continents[i]}: ${maleHeightMean[i]} m.\n`);
  }
  console.log ('Los porcentajes correspondientes (en función del número de ' +
          'países con cada religión) a las 5 religiones más extendidas en el '
+
          'mundo son:\n');
  for (let i = 0; i < popularReligions.length; ++i) {
          console.log (` -${popularReligions[i]}: ` +
          `${(religionDataSet[popularReligions[i]].count /
          totalReligious * 100).toFixed(2)}` +
          ' %\n');
  }
  console.log ('Los países con más bajas temperaturas en cada uno de los ' +
          'continentes son los siguientes:\n');
  for (let i = 0; i < continents.length; ++i) {
          console.log (` -${continents[i]}: ${coldestCountries[i].join(',
')}.\n`);
  }


  ...
};
```

## Code smell

- Too many parameters

```
function confusingFunction(bookName, lineNumber,
page, author, character, cover, publisher, age,
length, word, paper, editor, publishingYear,
awards, ...config) {
    // Does stuff
}
```

## Code smell

- Wrong Use of Equality (== vs ===)

```
const checkEmptyString(string) => {
  return string == '';
}

checkEmptyString(0);      // true
checkEmptyString('0');      // false
```

## Code smell

- Outdated Comments

```
/**
 * Planet Pluto
 */
const Pluto = new DwarfPlanet();
```

## Other code smells

- Duplicated Code
- Large class
- Almost empty class
- Changes must be made in multiple classes each time
- Unmeaningful names
- Excessively long identifier

## SOLID Principles

## Single Responsibility Principle

- “A class should have one, and only one, reason to change.”

## Open Closed Principle

- “Classes should be open for extension, closed for modification.”

## Liskov Substituition Principle

- “Derived classes must be substitutable for their base classes.”

## Interface Segregation Principle

- “Many client specific interfaces are better than one generic-purpose interface.”

# Dependency Inversion Principle

- "Everything should depend upon abstractions, not details."

# O ...ther Principles

## DRY

- “Don’t Repeat Yourself”
- Divide the logic of your system into smaller reusable pieces as much as possible.

## KISS

- “Keep It Simple and Stupid”
- Keep your methods small (should not be larger than 40-50 lines).
- Each method should only solve one small problem.

## YAGNI

- “You Ain’t Gonna Need It”
- Do not add any functionality until it’s deemed necessary.
- Carpe Diem, do not think in future needs

## Preference Principles

- Composition > Inheritance
- Interface > Implementation

## What should be common sense at this point

- Avoid Global stuff like the plague.
- If it changes, encapsulate.
- Delegate (prevent God Objects).

## Wrapping up

- JavaScript is far from the best in OOP.
- But if you use OOP, use ES6 classes.
- And more important: If you do, please use SOLID & Co.

## References

- Software design principles
- OOP best practices
- 10 OOP principles
- Code Smell
- SOLID Code Examples

## References

- More SOLID code examples
- SOLID in TypeScript
- KISS example
- DRY example
- Why Global stuff is dangerous

# THANKS!

Any questions?

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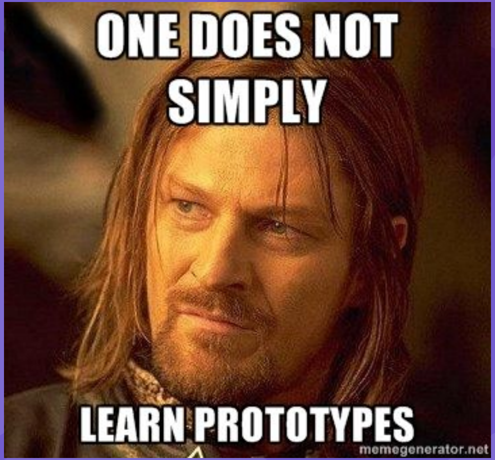
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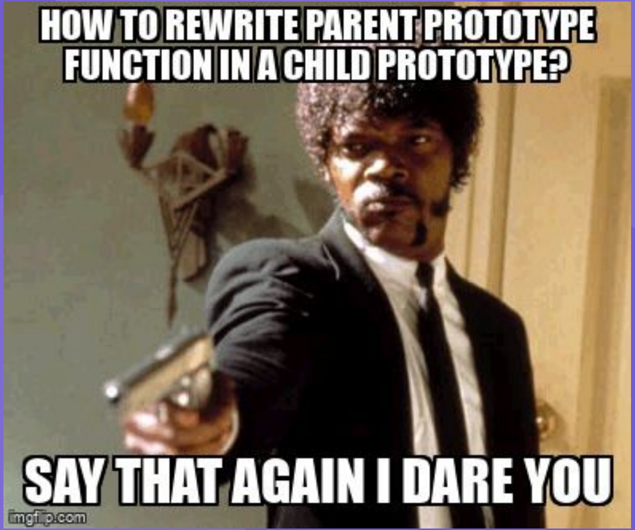
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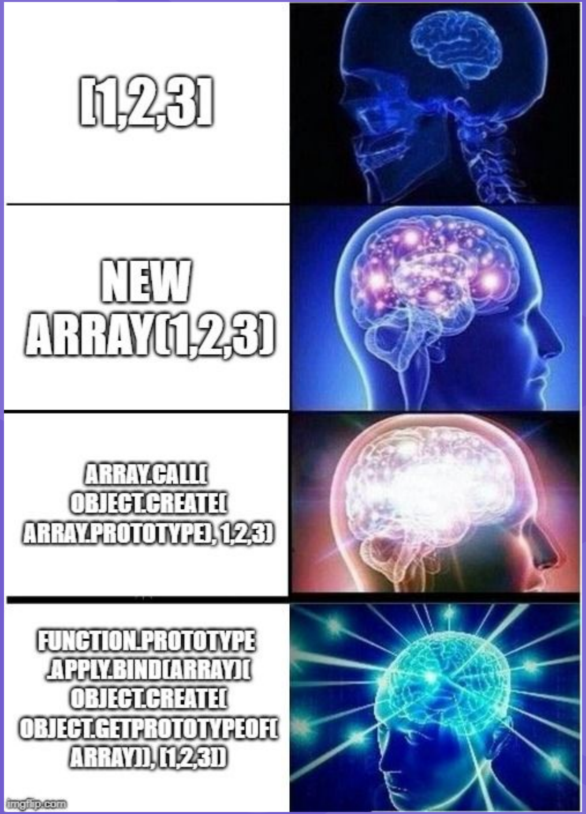
[1,2,3]
NEW ARRAY(1,2,3)
ARRAY.CALL( OBJECT.CREATE( ARRAY.PROTOTYPE), 1,2,3)
FUNCTION.PROTOTYPE .APPLY.BIND(ARRAY)( OBJECT.CREATE( OBJECT.GETPROTOTYPEOF( ARRAY)), [1,2,3])
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