# OOP
# S.O.L.I.D.
# principles

## PHP WebDevelopment 2019

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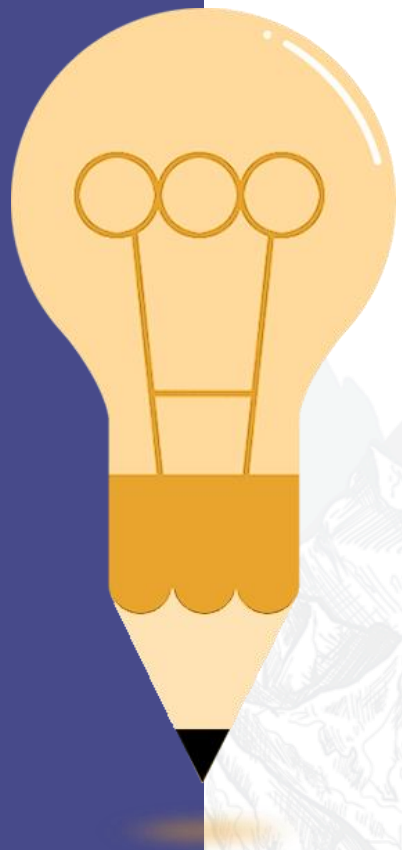
# Table of Contents

# SOLID pronciples

Враца Софтуер Общество



The **First 5 principles** in the OOP design, are as follows

**S** - Single-responsiblity principle

**O** - Open-closed principle

**L** - Liskov substitution principle

**I** - Interface segregation principle

**D** - Dependency Inversion Principle


S - single
responsibility
principle

# Single responsibility principle

TASK

**Create** a web application using OOP that will sum the areas of two different geometric figures /for example a circle and a triangle/.

# Single responsibility principle

**A class should have ONLY one job.**

**Step 1 Define**

```
class Circle {
        public $radius;

    public function_construct($radius) {
                $this->radius = $radius;
        }
}
```

**Step 2 Define**

```
class Square {
        public $length;

    public function __construct($length){
        $this->length = $length;
        }
}
```

# Single responsibility principle

Врача Софтуер Общество

**A class should have ONLY one job.**

```
Step 3 Define

class AreaCalculator {

        protected $shapes;

        public function __construct($shapes = []) {
                $this->shapes = $shapes;
        }
        public function sum() {
                // logic to calculate and sum the areas
        }
        public function output() {
                return "Sum of the areas of provided shapes: ". $this->sum();
        }
}
```

# Single responsibility principle

Врача Софтуер Общество

**A class should have ONLY one job.**

**Step 4** Create an array of geometric figures /objects of class Circle, Square etc./

```
$shapes = [
    new Circle(2),
    new Square(5),
    new Square(6)
];
```

**Step 5** Create an instance of class AreaCalculator. Pass the geometric figures array as a parameter.

```
$areas = new AreaCalculator($shapes);
```

**Step 6** Print the sum of all areas.

```
echo $areas->output();
```

# Single responsibility principle

TASK 1

**B. Print** the results of AreaCalculator in different formats. /for example JSON, HTML/

# O - open-closed principle

# Open-closed principle

Врача Софтуер Общество

## Objects or entities should be open for extension, but closed for modification

Lets implement **AreaCalculator`s sum** method this way

```
public function sum() {
    foreach($this->shapes as $shape) {
        if(is_a($shape, 'Square')) {
            $area[] = pow($shape->length, 2);
        } else if(is_a($shape, 'Circle')) {
            $area[] = pi() * pow($shape->radius, 2);
        }
    }
    return array_sum($area);
}
```

We have limited the application to calculate the areas of 2 type of figures.
How to resolve the problem of such limitation - to open the application to calculate and sum the areas of unlimited number of figures?

# Open-closed principle

Врача Софтуер Общество

**Objects or entities should be open for extension, but closed for modification**

We have limited the application to calculate the areas of 2 type of figures - Circles and Square.

How to resolve the problem of such inefficiency - to **open the application** to calculate and sum the areas of **unlimited number** of figures?

# Open-closed principle

Врача Софтуер Общество

**Objects or entities should be open for extension, but closed for modification**

**Variant A**

- add more if/else blocks for every geometric figure ...in advance … or later …
**Which is against the 2nd SOLID principle.**

**Variant B**

**Move** the logic of the area calculation **from AreaCalculator** class
and **define it in** every single geometric figure class -
**class Circle, class Square** etc.

# Open-closed principle

Врача Софтуер Общество

**Objects or entities should be open for extension, but closed for modification**

```
class Square {
    public $length;

    public function __construct($length) {
        $this->length = $length;
    }

    public function calc_area() {
        return pow($this->length, 2);
    }
}
```

*Define **calc_area** method*
*in every geometric figure class.*

# Open-closed principle

Врача Софтуер Общество

**Objects or entities should be open for extension, but closed for modification**

Replace the **sum method** implementation in **AreaCalculator** with -

```
public function sum() {
    foreach($this->shapes as $shape) {
        $area[] = $shape->calc_area();
    }
    return array_sum($area);
}
```

The method logic **does not depend** on the **type** or the **number** of the figures anymore.

# Open-closed principle

Врача Софтуер Общество

## Objects or entities should be open for extension, but closed for modification

We can define a class for other geometric type of figure, create instances and include them in the **$shapes** array to calculate the sum of areas.

*There are some important questions.*

- How to be sure that every **object** in **$shapes** is a geometric figure?
- How to be sure that the class the object is instance of **has a definition of calc_area**()?

# Open-closed principle

Врача Софтуер Общество

**Objects or entities should be open for extension, but closed for modification**

**Step 1** Define a iShape interface

```
interface iShape {
    public function calc_area();
}
```

# Open-closed principle

Врача Софтуер Общество

**Objects or entities should be open for extension, but closed for modification**

**Step 2** Every class responsible for a geometric figure will implement that interface

```
class Square implements iShape {
    public $length;

    public function __construct($length) {
        $this->length = $length;
    }
    public function calc_area() {
        return pow($this->length, 2);
    }
}
```

# Open-closed principle

Врача Софтуер Общество

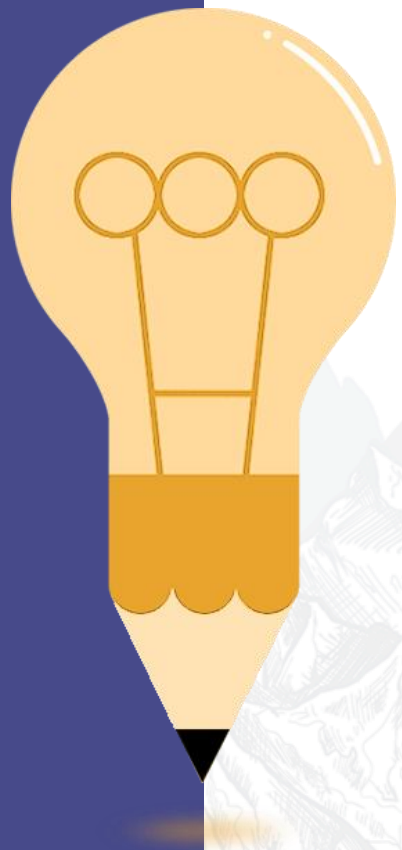
**Objects or entities should be open for extension, but closed for modification**

**Step 3** The **sum method** of **AreaCalculator** checks if every object is an instance of a class that implements iShape.

```
public function sum() {
    foreach($this->shapes as $shape) {
        if(is_a($shape, 'iShape')) {
            $area[] = $shape->area();
        } else {
            continue;
       }
      }
    return array_sum($area);
}
```

# L - liskov substitution principle

# Liskov substitution principle



Any class that is the child of a parent class should be usable in place of its parent without any unexpected behaviour

*If a class **S extends** the class **T**, an instance of T can **be replaced** with an instance of S without affecting the program expected results or causing any errors.*

# Liskov substitution principle

Any class that is the child of a parent class should be usable in place of its parent without any unexpected behaviour

**Step 1**

```
class Vehicle {

    function startEngine() {
        // Default engine start functionality
    }

    function accelerate() {
        // Default acceleration functionality
    }
}
```

**Step 2**

```
class Car extends Vehicle {

    function startEngine() {
        $this->engageIgnition();
        parent::startEngine();
    }

    private function engageIgnition() {
        // Ignition procedure
    }

}
```

# Liskov substitution principle

Any class that is the child of a parent class should be usable in place of its parent without any unexpected behaviour

```
class ElectricBus extends Vehicle {

    function accelerate() {
        $this->increaseVoltage();
        $this->connectIndividualEngines();
    }

    private function increaseVoltage() {
        // Electric logic
    }

    private function connectIndividualEngines() {
        // Connection logic
    }
}
```

# Liskov substitution principle

Any class that is the child of a parent class should be usable in place of its parent without any unexpected behaviour

**Step 3**

```
class ElectricBus extends Vehicle {

    function accelerate() {
        $this->increaseVoltage();
        $this->connectIndividualEngines();
    }

    private function increaseVoltage() {
        // Electric logic
    }
    private function connectIndividualEngines() {
        // Connection logic
    }
}
```

# Liskov substitution principle

Врача Софтуер Общество

Any class that is the child of a parent class should be usable in place of its parent without any unexpected behaviour

**Step 4**

```
class Driver {

    function go(Vehicle $v) {
        $v->startEngine();
        $v->accelerate();
    }

}
```

A client class - **Driver**

should be able **to use** either of them -

*Vehicle,*
*Car,*
*ElectricBus*

if it can use **Vehicle**.

# I - interface segregation principle

# Interface segregation principle

Враца Софтуер Общество

A client should never be forced to implement an interface that it doesn't use or clients shouldn't be forced to depend on methods they do not use.

Let`s add a new functionality
to the Calculator App -

it should calculate figures` volume
also.

We can extend the iShape interface ->

```
interface iShape {
    public function calc_area();
    public function calc_volume();
}
```

# Interface segregation principle

Врача Софтуер Общество

A client should never be forced to implement an interface that it doesn't use or clients shouldn't be forced to depend on methods they do not use.

```
class Cube extends Square {
    public $flat_area;
    public function __construct( $s){
            parent::__construct( $s );
            $this->flat_area = parent::calc_area();
    }
    public function calc_area(){
            return $this->flat_area * 6;
    }
    public function calc_volume(){
            $this->is_positive_number( $this->side );
            return $this->flat_area * $this->side;
    }
}
```

For the 3D figures the iShape interface fits fine.

**But how about the 2D figures?**

It will be a nonsense to force them to implement a method for calculating a volume ...

# Interface segregation principle

Врача Софтуер Общество

A client should never be forced to implement an interface that it doesn't use or clients shouldn't be forced to depend on methods they do not use.

We have to split the iShape
interface
and define

**two separate interfaces.**

```
interface iFlatShape {
    public function calc_area();
}


interface iThreeDShape {
   public function calc_volume();
}
```

# Interface segregation principle

A client should never be forced to implement an interface that it doesn't use or clients shouldn't be forced to depend on methods they do not use

```
class Square implements iFlatShape {
        ...
        public function calc_area(){

                ...
        }
    }
```

```
class Cube extends Square implements iThreeDShape {
        ...
        public function calc_volume(){
                ...
        }
    }
```

# D - dependency inversion principle

# Dependency inversion principle

Врача Софтуер Общество

* High-level modules should not depend on low-level modules. Both should depend on abstractions.
* Abstractions should not depend upon details. Details should depend upon abstractions.

```
class Mailer {

   // Methods for a Mailer class

}
```

```
class SendWelcomeMessage {

   private $mailer;

   public function __construct(Mailer
$mailer)

   {

      $this->mailer = $mailer;

   }

}
```

# Dependency inversion principle

Врача Софтуер Общество

* High-level modules should not depend on low-level modules. Both should depend on abstractions.
* Abstractions should not depend upon details. Details should depend upon abstractions.

---

```
class SmtpMailer {

   // Methods for a Mailer class

}
```

```
class SendWelcomeMessage {

    private $mailer;

    public function __construct(SmtpMailer $mailer){

                $this->mailer = $mailer;

    }

}
```

# Dependency inversion principle

Врача Софтуер Общество

* High-level modules should not depend on low-level modules. Both should depend on abstractions.
* Abstractions should not depend upon details. Details should depend upon abstractions.

---

What if we want to send a notification via Slack?

Or via SMS?
Or via Mail but to use GMAIL server instead MAILGUN … OR … etc etc ...

The module responsible for notifications should not depend on the details - the module that sends the notification.

# Dependency inversion principle

Врача Софтуер Общество

* High-level modules should not depend on low-level modules. Both should depend on abstractions.
* Abstractions should not depend upon details. Details should depend upon abstractions.

**Step 1** Define an interface

```
interface SendNotificationInterface {
    public function send_notification();
}
```

**Step 2** Modules responsible for sending notifications must implements the SendNotificationInterface

```
class SmtpMailer implements SendNotificationInterface
{
    public function send_notification()   {
            // Send an email via SMTP
    }
}
```

```
class SlackNotificator implements SendNotificationInterface
{
    public function send_notification()   {
            // Send an email via SMTP
    }
}
```

# Dependency inversion principle

Врача Софтуер Общество

* High-level modules should not depend on low-level modules. Both should depend on abstractions.
* Abstractions should not depend upon details. Details should depend upon abstractions.

**Step 3** The class constructor expects an instance of a class that implements the SendNotificationInterface - **the module depends on abstractions not details.**

```
class SendWelcomeMessage {

    private $mailer;

    public function __construct(MailerInterface $mailer){
        $this->mailer = $mailer;
    }

}
```


Trait

# Trait

Traits are a mechanism for code reuse in single inheritance languages such as PHP.

**Step 1**

```
trait Validator {

    public function is_positive_number( $num ) {
        if( $num < 0 || $num == 0 ){
                    return “You need to provide dimension
  > 0!”;
        }
    }
}
```

- *Declared with the keyword trait in front of the name;*
- *Define one or more methods for reuse in different, not connected by inheritance classes;*
- *If a class uses a trait - trait`s methods are available for classes that inherit the class also;*

# Trait

Step 2

```
class Square implements iShape {

    use Validator;

    public $length;

    public function __construct($length) {
        $this->length = $length;
    }
    public function calc_area() {
        $this->is_positive_number( $this->length );
        return pow($this->length, 2);
      }
    }
```

- *Declare the class is using the trait with use Validator;*
- *Call the trait`s methods from the class with $this keyword;*
- *You are not obliged to call all trait`s method in the class;*

# Namespaces

# Namespace

```php
<?php
    namespace Foo\Bar\subnamespace;

    class Foo{

        static function staticmethod() {}

    }
```

- *Declare the current namespace with the keyword namespace;*
- *The namespace must be declared immediately after the opening PHP tag - no blank lines allowed!*
- *The path that follows is the path that corresponds to the current file`s location in files hierarchy of the project*
- *You are not obliged to call all trait`s method in the class;*

# Namespace

```php
<?php
    namespace Foo\Bar\subnamespace2;

    use namespace Foo\Bar\subnamespace\Foo;
    use …

    class Demo {

        public function some_method(){
                    //script
                    Foo::staticmethod();
        }
    }
```

- *Declare the current namespace with the keyword namespace;*
- *After the namespace declaration call the needed files with the use keyword;*
- *Call a class method by referring to class name only;*

# Questions?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