ĐẠI HỌC BÁCH KHOA HÀ NỘI
VIỆN CÔNG NGHỆ THÔNG TIN VÀ TRUYỀN THÔNG

IT4552 – Web programming

Chapter 5. OOP in PHP

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Object-Oriented Programming (OOP)

- **Object**: Instance (occurrance) of a **class**
- Classes/Objects **encapsulates** their data (called **attributes**) and behaviour (called **methods**)
- **Inheritance**: Define a new class by saying that it's like an existing class, but with certain new or changed attributes and methods.
  - The old class: superclass/parent/base class
  - The new class: subclass/child/derived class

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PHP 5

- Single-inheritance
- Access-restricted
- Overloadable
- Object ~ pass-by-reference

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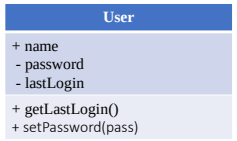
1. Creating an Object

- Syntax:
  - ***$object = new Class([agrs]);***
- E.g.:
  - $obj1= new User();
  - $obj2 = new User('Fred', "abc123"); //args
  - $obj3 = new 'User'; // does not work
  - $class = 'User'; $obj4= new $class; //ok



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2. Accessing Attributes and Methods

- *Syntax: Using ->*
  - ***$object->attribute_name***
  - ***$object->method_name([arg, ...])***
- E.g.

```
// attribute access
$obj1->name = "Micheal";
print("User name is " . $obj1->name);
$obj1->getLastLogin( ); // method call
// method call with args
$obj1->setPassword("Test4");
```


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3.1. Syntax to declare a Class

```
class ClassName [extends BaseClass]{
    [[var] access $attribute [ = value ]; ...
     ]
    [access function method_name (args) {
        // code
      } ...
    ]
}
```

- access can be: **public**, **protected** or **private** (default is public).
- ClassNames, atributes, methods are case-sensitive and conform the rules for PHP identifiers
- attributes or methods can be declared as **static** or **const**

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Rules for PHP Identifiers

- Must include:
  - **ASCII letter (a-zA-Z)**
  - **Digits (0-9)**
  - _
  - ASCII character between **0x7F (DEL) and 0xFF**
- Do not start by a digit

Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char
128	80	Ç	160	A0	á	192	C0	└	224	E0	α
129	81	ü	161	A1	í	193	C1	┴	225	E1	ß
130	82	é	162	A2	ó	194	C2	┬	226	E2	Γ
131	83	â	163	A3	ú	195	C3	├	227	E3	π
132	84	ä	164	A4	ñ	196	C4	─	228	E4	Σ
133	85	à	165	A5	Ñ	197	C5	┼	229	E5	σ
134	86	å	166	A6	ª	198	C6	╞	230	E6	µ
135	87	ç	167	A7	º	199	C7	╟	231	E7	τ
136	88	ê	168	A8	¿	200	C8	╚	232	E8	Φ
137	89	ë	169	A9	⌐	201	C9	╔	233	E9	Θ
138	8A	è	170	AA	¬	202	CA	╩	234	EA	Ω
139	8B	ï	171	AB	½	203	CB	╦	235	EB	δ
140	8C	î	172	AC	¼	204	CC	╠	236	EC	∞
141	8D	ì	173	AD	¡	205	CD	═	237	ED	ø
142	8E	Ä	174	AE	«	206	CE	╬	238	EE	ε
143	8F	Å	175	AF	»	207	CF	╧	239	EF	∩
144	90	É	176	B0	░	208	D0	╨	240	F0	≡
145	91	æ	177	B1	▒	209	D1	╤	241	F1	±
146	92	Æ	178	B2	▓	210	D2	╥	242	F2	≥
147	93	ô	179	B3	│	211	D3	╙	243	F3	≤
148	94	ö	180	B4	┤	212	D4	╘	244	F4	⌠
149	95	ò	181	B5	╡	213	D5	╒	245	F5	⌡
150	96	û	182	B6	╢	214	D6	╓	246	F6	÷
151	97	ù	183	B7	╖	215	D7	╫	247	F7	≈
152	98	ÿ	184	B8	╕	216	D8	╪	248	F8	°
153	99	Ö	185	B9	╣	217	D9	┘	249	F9	∙
154	9A	Ü	186	BA	║	218	DA	┌	250	FA	·
155	9B	¢	187	BB	╗	219	DB	█	251	FB	√
156	9C	£	188	BC	╝	220	DC	▄	252	FC	ⁿ
157	9D	¥	189	BD	╜	221	DD	▌	253	FD	²
158	9E	₧	190	BE	╛	222	DE	▐	254	FE	■
159	9F	ƒ	191	BF	┐	223	DF	▀	255	FF	

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Example – Define User class

```
//define class for tracking users
class User {
    public $name;
    private $password, $lastLogin;
    public function __construct($name, $password)
      {
        $this->name = $name;
        $this->password = $password;
        $this->lastLogin = time();
    }
    function getLastLogin() {
        return(date("M d Y", $this->lastLogin));
    }
}
```

User
+ name - password - lastLogin
+ getLastLogin()

A special variable for the particular instance of the class

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3.2. Constructors and Destructors

- Constructor
  - **`__construct([agrs])`**
  - executed immediately upon creating an object from that class
- Destructor
  - **`__destruct()`**
  - calls when we want to destroy the object
- 2 special namespaces:
  - self: refers to the current class
  - parent: refers to the immediate ancestor
    - Call parents' constructor: `parent::__construct`

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Example

```
<?php
   class BaseClass {
      function __construct() {
          print "In BaseClass constructor\n"
   ;
      }
   }

   class SubClass extends BaseClass {
      function __construct() {
          parent::__construct();
          print "In SubClass constructor\n";
      }
   }

   $obj = new BaseClass();
   $obj = new SubClass();
?>
```


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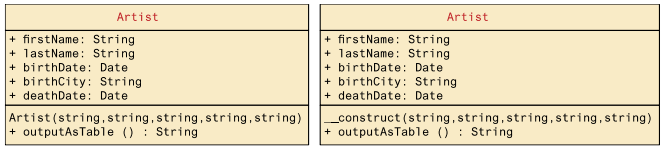
3.2. Constructors and Destructors

- UML (two ways to show constructor)



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3.3. Static & constant class members

- Static member
  - Not relate/belong to an any particular object of the class, but to the class itself.
  - Cannot use **`$this`** to access static members but can use with **`self`** namespace or ClassName.
  - E.g.
    - count is a static attribute of Counter class
    - **`self::$count`** or **`Counter::$count`**
- Constant member
  - value cannot be changed
  - can be accessed directly through the class or within object methods using the **`self`** namespace.

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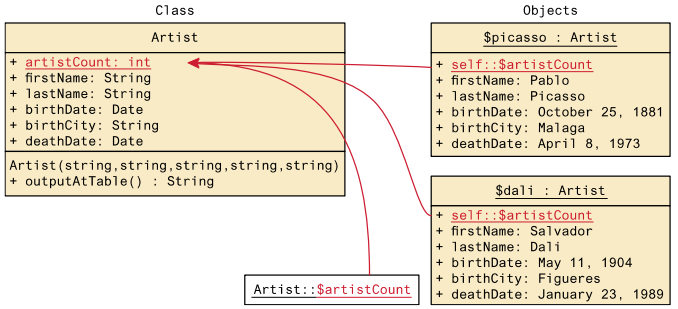
3.3. Static & constant class members



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Example

```
class Counter {
    private static $count = 0;
    const VERSION = 2.0;
    function __construct(){ self::$count++; }
    function __destruct(){ self::$count--; }
    static function getCount() {
        return self::$count;
    }
}
$c1 = new Counter();
print($c1->getCount() . "<br>\n");
$c2 = new Counter();
print(Counter::getCount() . "<br>\n");

$c2 = NULL;
print($c1->getCount() . "<br>\n");
print("Version used: ".Counter::VERSION."<br>\n");
```

```
1
2
1
Version used: 2
```


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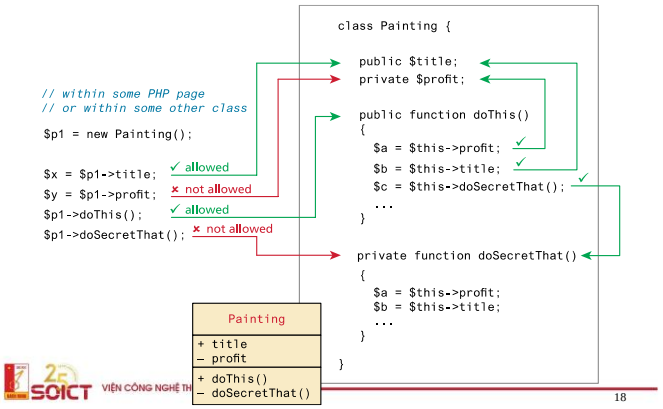
Visibility

- UML (Visibility)



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3.4. Cloning Object

- `$a = new SomeClass();`
- `$b = $a;`
- **`$a and $b point to the same underlying instance of SomeClass`**
- → Changing $a attributes' value also make $b attributes changing
- → Create a replica of an object so that changes to the replica are not reflected in the original object? → CLONING

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3.4. Object Cloning

- Special method in every class: **`__clone()`**
  - Every object has a default implementation for **`__clone()`**
  - Accepts no arguments
- Call cloning:
  - **`$copy_of_object = clone $object;`**
  - **E.g.**

```
$a = new SomeClass();
$b = clone $a;
```


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Example - Cloning

```
class ObjectTracker {
    private static $nextSerial = 0;
    private $id, $name;
    function __construct($name) {
        $this->name = $name;
        this->id = ++self::$nextSerial;
    }
    function __clone(){
        $this->name = "Clone of $this->name";
        $this->id = ++self::$nextSerial;
    }
    function getId() { return($this->id); }
    function getName() { return($this->name); }
    function setName($name) { $this->name = $name; }
}
$ot = new ObjectTracker("Zeev's Object");
$ot2 = clone $ot; $ot2->setName("Another object");
print($ot->getId() . " " . $ot->getName() . "<br>");
print($ot2->getId() . " " . $ot2->getName() . "<br>");
```

Hello world!
1 Zeev's Object
2 Another object

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3.5. User-level overloading

- Overloading in PHP provides means dynamic "create" attributes and methods.
- The overloading methods are invoked when interacting with attributes or methods that have not been declared or are not visible in the current scope
  - inaccessible properties
- All overloading methods must be defined as *public*.

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3.5.1. Attribute overloading

- **`void __set (string $name , mixed $value)`**
  - is run when writing data to inaccessible attributes
- **`mixed __get (string $name)`**
  - is utilized for reading data from inaccessible attributes
- **`bool __isset (string $name)`**
  - is triggered by calling isset() or empty() on inaccessible attributes
- **`void __unset (string $name)`**
  - is invoked when unset() is used on inaccessible attributes

Note: The return value of **__set()** is ignored because of the way PHP processes the assignment operator. Similarly, **__get()** is never called when chaining assignments together like this:

$a = $obj->b = 8;

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Example - Attribute overloading

```
class PropertyTest {
    private $data = array();
    public $declared = 1;
    private $hidden = 2;
    public function __set($name, $value) {
      echo "Setting '$name' to '$value'<br>";
      $this->data[$name] = $value;
    }
    public function __get($name) {
        echo "Getting '$name'<br>";
        if (array_key_exists($name, $this->data)) {
            return $this->data[$name];
        }
    }
    public function __isset($name) {
        echo "Is '$name' set?<br>";
        return isset($this->data[$name]);
    }
     public function __unset($name) {
        echo "Unsetting '$name'<br>";
        unset($this->data[$name]);
    }
    public function getHidden() {
        return $this->hidden;
    }
}
```

```
Setting 'a' to '1'
Getting 'a'
1
Is 'a' set?
bool(true) Unsetting 'a'
Is 'a' set?
bool(false)
1
2
Getting 'hidden'
```

```
$obj = new PropertyTest;

$obj->a = 1;
echo $obj->a."<br>";

var_dump(isset($obj->a));
unset($obj->a);
var_dump(isset($obj->a));
echo "<br>";

echo $obj->declared."<br>";
echo $obj->getHidden()."<br>";
echo $obj->hidden."<br>";
```


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3.5.2. Method overloading

- **mixed __call (string $name, array $arguments)**
  - is triggered when invoking inaccessible methods in an object context
- **mixed __callStatic (string $name, array $arguments)**
  - is triggered when invoking inaccessible methods in a static context.

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Example – Method Overloading

```
class MethodTest {
   public function __call($name, $arguments) {
        // Note: value of $name is case sensitive.
        echo "Calling object method '$name' "
                . implode(', ', $arguments). "<br>";
   }

   public static function __callStatic($name, $arguments)
   {
        // Note: value of $name is case sensitive.
        echo "Calling static method '$name' "
                . implode(', ', $arguments). "<br>";
   }
}

$obj = new MethodTest;
$obj->runTest('in object context');
MethodTest::runTest('in static context');
```

Calling object method 'runTest' in object context
Calling static method 'runTest' in static context

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```
<?php
   class Foo {
      static $vals;
      public static function __callStatic($func, $args) {
               if (!empty($args)) {
                   self::$vals[$func] = $args[0];
               } else {
                   return self::$vals[$func];
               }
          }
      }
   ?>

   Which would allow you to say:

   <?php
       Foo::username('john');
       print Foo::username(); // prints 'john'
   ?>
```


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3.6. Autoloading class

- Using a class you haven't defined, PHP generates a fatal error
- → Can use **include** statement
- → Can use a global function **__autoload()**
  - single parameter: the name of the class
  - automatically called when you attempt to use a class PHP does not recognize

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Example - Autoloading class

```
//define autoload function
function __autoload($class) {
   include("class_".ucfirst($class).".php");
}
//use a class that must be autoloaded
$u = new User;
$u->name = "Leon";
$u->printName();
```


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3.7. Namespace

- ~folder, ~package
- Organize variables, functions and classes
- Avoid confliction in naming variables, functions and classes
- The **`namespace`** statement gives a name to a block of code
- From outside the block, scripts must refer to the parts inside with the name of the namespace using the `::` operator

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3.7. Namespace (2)

- You cannot create a hierarchy of namespaces
- → namespace's name includes colons as long as they are not the first character, the last character or next to another colon
- → use colons to divide the names of your namespaces into logical partitions like parent-child relationships to anyone who reads your code
- E.g. **`namespace hedspi:is1 { ... }`**

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Example - Namespace

```
namespace core_php:utility {
    class TextEngine {
       public function uppercase($text) {
            return(strtoupper($text));
       }
    }
    function uppercase($text) {
       $e = new TextEngine;
       return($e->uppercase($text));
    }
}
$e = new core_php:utility::TextEngine;
print($e->uppercase("from object")    "<br>");
print(core_php:utility::uppercase("from function")
                                          ."<br>");
import class TextEngine from core_php:utility;
$e2 = new TextEngine;
```

import * from myNamespace

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3.8. Abstract methods and abstract classes

- Single inheritance
- Abstract methods, abstract classes, interface (implements) like Java
- You cannot instantiate an abstract class, but you can extend it or use it in an **`instanceof`** expression

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```
abstract class Shape {
    abstract function getArea();
}
abstract class Polygon extends Shape {
    abstract function getNumberOfSides();
}
class Triangle extends Polygon {
    public $base;
    public $height;
    public function getArea() {
        return(($this->base * $this->height)/2);
    }
    public function getNumberOfSides() {
        return(3);
    }
}
```


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```
class Rectangle extends Polygon {
    public $width; public $height;
    public function getArea() {
        return($this->width * $this->height);
    }
    public function getNumberOfSides() {
        return(4);
    }
}
class Circle extends Shape {
    public $radius;
    public function getArea() {
        return(pi() * $this->radius * $this->radius);
    }
}
class Color {
   public $name;
}
```


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```
$myCollection = array();
$r = new Rectangle; $r->width = 5; $r->height = 7;
$myCollection[] = $r; unset($r);
$t = new Triangle; $t->base = 4; $t->height = 5;
$myCollection[] = $t; unset($t);
$c = new Circle; $c->radius = 3;
$myCollection[] = $c; unset($c);
$c = new Color; $c->name = "blue";
$myCollection[] = $c; unset($c);
foreach($myCollection as $s) {
   if($s instanceof Shape) {
      print("Area: " . $s->getArea() . "<br>\n");
   }
   if($s instanceof Polygon) {
      print("Sides: " . $s->getNumberOfSides() . "<br>\n");
   }
   if($s instanceof Color) {
      print("Color: $s->name<br>\n");
   }
   print("<br>\n");
}
```


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Content

1. Creating an Object
2. Accessing attributes and methods
3. Building a class
4. Introspection

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4. Introspection

- Ability of a program to examine an object's characteristics, such as its name, parent class (if any), attributes, and methods.
- Discover which methods or attributes are defined when you write your code at runtime, which makes it possible for you to write generic debuggers, serializers, profilers, etc

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4.1. Examining Classes

- **`class_exists(classname)`**
  - determine whether a class exists
- **`get_declared_classes()`**
  - returns an array of defined classes
- **`get_class_methods(`*`classname`*`)`**
  - Return an array of methods that exist in a class
- **`get_class_vars (`*`classname`*`)`**
  - Return an array of attributes that exist in a class
- **`get_parent_class(classname)`**
  - Return name of the parent class
  - Return FALSE if there is no parent class

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```
function display_classes ( ) {
    $classes = get_declared_classes( );
    foreach($classes as $class) {
        echo "Showing information about $class<br />";
        echo "$class methods:<br />";
        $methods = get_class_methods($class);
        if(!count($methods)) {
            echo "<i>None</i><br />";
        } else { foreach($methods as $method) {
                    echo "<b>$method</b>( )<br />";
                }
        }
        echo "$class attributes:<br />";
        $attributes = get_class_vars($class);
        if(!count($attributes)) { echo "<i>None</i><br />"; }
        else {
            foreach(array_keys($attributes) as $attribute) {
               echo "<b>\$$attribute</b><br />";
            }
        }
        echo "<br />";
    }
}
```


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4.2. Examining an Object

- `is_object(object)`
  - Check if a variable is an object or not
- `get_class(object)`
  - Return the class of the object
- `method_exists(object, method)`
  - Check if a method exists in object or not
- `get_object_vars( object)`
  - Return an array of attributes that exist in a class
- `get_parent_class(object)`
  - Return the name of the parent class
  - Return FALSE if there is no parent class

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Question?

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