# Design Patterns

MAS Foundations Course WS-19 **Hochschule Bonn-Rhein-Sieg** 

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### Outline

- What are Design Patterns?
- Strategy Pattern
- **Decorator Pattern**
- Singleton Pattern

### Design Pattern

Design Patterns are used to represent the flow used by developers for the development of a particular software.

#### Why Design Patterns?

- Design Patterns describe about
  - Solution to the problem.
  - When and where to apply that solution.
  - Consequences of applying that solution.

### Design Patterns (cont'd)

- Design Patterns are independent of language of implementation.
- Types of Design Patterns:
  - Creational Design Patterns more concern on the way of object creation.
  - Structural Design Patterns gives importance on relations between the classes and simplifying the structure
  - o **Behavioral Patterns** concern on the interaction of objects and their responsibilities.
- Some Design Patterns:
  - Singleton
  - Factory
  - Prototype
  - Decorator
  - o Flyweight, etc...

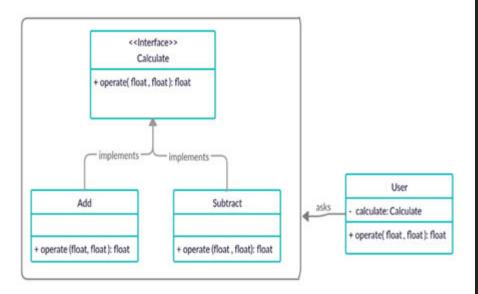
### Strategy Pattern

- Behavioral Pattern
- ➤ It enables the user to use different algorithms for a particular task.
- > Also known as **Policy**.
- ➤ Advantage is ease of incorporation of new behaviours into the existing code.

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### Strategy Pattern (cont'd)

#### UML Diagram:



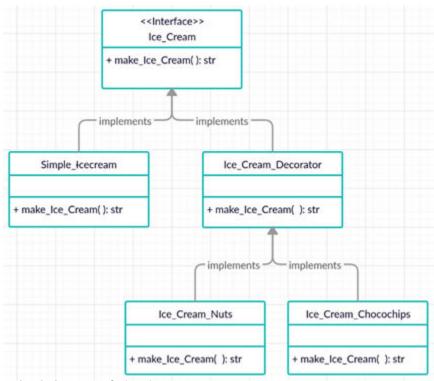
```
class Calculate(ABC):
    @abstractmethod
    def operate(self, x, y):
class Add(Calculate):
    def operate(self, x, y):
        print("operate function in Add class")
        return x+v
class Subtract(Calculate):
    def operate(self, x, y):
        print("operate function in Subtract class")
        return x-y
class User(Calculate):
      calculate = None
    def init (self, function):
        self. calculate = function()
    def operate(self, x, y):
        return self. calculate.operate(x, y)
add = User(Add)
print("Addition class: ")
print(add.operate(3, 4))
subtract = User(Subtract)
print("Subtract class: ")
print(subtract.operate(7, 4))
```

#### **Decorator Pattern**

- > Structural Pattern
- ➤ It is used in the scenarios where the object is added with extra responsibilities dynamically.
- > For example let object is used to make Ice Cream an additional seasoning is added as decorator for that object.
- > Also called as Wrapper.

### Decorator Pattern (cont'd)

#### UML Diagram:



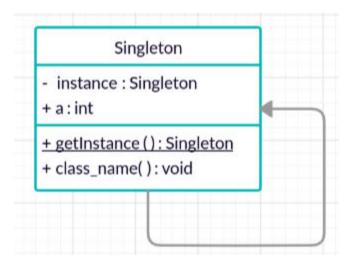
```
class Ice Cream():
    def make Ice Cream(self):
class Simple Icecream(Ice Cream):
    def make Ice Cream(self):
        return "Basic Icecream"
class Ice Cream Decorator(Ice Cream):
    def init (self, special Ice Cream):
        self.special Ice Cream = special Ice Cream
    def make Ice Cream(self):
        return Simple Icecream.make Ice Cream()
class Ice Cream Nuts(Ice Cream Decorator):
   def init (self, special Ice Cream):
        super(). init (special Ice Cream)
    def make Ice Cream(self):
        return self.special Ice Cream.make Ice Cream()+" With Nuts"
class Ice Cream Chocochips(Ice Cream Decorator):
    def init (self, special Ice Cream):
        super(). init (special Ice Cream)
    def make Ice Cream(self):
        return self.special Ice Cream.make Ice Cream()+" With Chocochips"
basic ice cream = Simple Icecream()
print(basic ice cream.make Ice Cream())
nuts ice cream = Ice Cream Nuts(basic ice cream)
print(nuts ice cream.make Ice Cream())
chips ice cream = Ice Cream Chocochips(basic ice cream)
print(chips ice cream.make Ice Cream())
top ice cream = Ice Cream Chocochips(nuts ice cream)
print(top ice cream.make Ice Cream())
```

### Singleton Pattern

- > Creational Pattern
- > This pattern allows the single instance of the class and this instance acts as global access point.
- This pattern is used when memory requirements are strict and it widely used in multi-threading and database applications such as logging, caching, etc.
- > Based on time of creation of instance, Singleton Pattern can be divided into two forms:
  - Early Instantiation: Instances are created at time of loading.
  - Lazy Instantiation: Instances are created when required.

## Singleton Pattern (cont'd)

#### UML Diagram:



```
instance = None
    a = 10
    @staticmethod
    def getInstance():
        """ Static access method. """
        if Singleton. instance is None:
            Singleton()
        return Singleton. instance
    def init (self):
        """ Virtually private constructor. """
        if Singleton. instance is not None:
            raise Exception("This class is a singleton!")
            Singleton. instance = self
    def class name(self):
        print("You are in Singleton class..")
s = Singleton()
s.kill()
s.a = 50
print(s.a)
print s
s1 = Singleton.getInstance()
sl.kill()
print(sl.a)
s1.a = 100
print(s.a)
print(s1.a)
print sl
s2 = Singleton.getInstance()
print s2
```

#### References:

- <u>Learn Design Patterns for absolute beginners</u> tutorialspoint
- <u>Design Patterns in Java</u> Javatpoint.
- <u>Design Patterns</u> Christopher Okhravi.

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