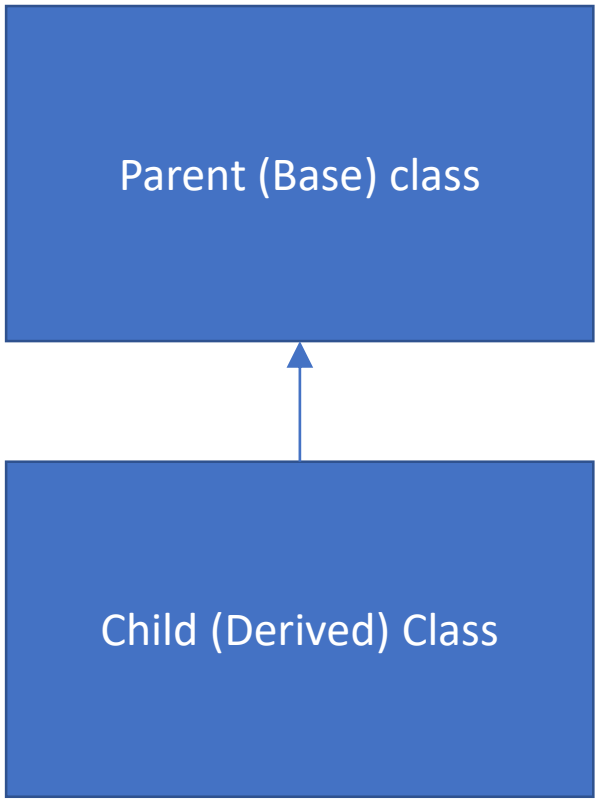
The
S.O.L.I.D. Principles

of Object Oriented Programming

Object-Oriented programming

- Encapsulation
- Abstraction
- Inheritance
- Polymorphism
- Decoupling

Inheritance



Inheritance

```
class ParentClass
   {
       public int Property1 { get; set; }
       public string Property2 { get; set; }

       public void DoSomething(int param1)
       {
           // Code here
       }
   }
```

```
class ChildClass : ParentClass
   {
   }
```

```
var child = new ChildClass();
           child.Property1 = 1;
           child.Property2 = "Foo";
           child.DoSomething(99);
```

Interface Inheritance

```
interface MyInterface
    {
        int Property1 { get; set; }
        string Property2 { get; set; }
        void DoSomething(int param1);
    }
```

```
class ChildClass : MyInterface
    {
        public int Property1 { get; set; }
        public string Property2 { get; set; }
        public void DoSomething(int param1)
        {
            // Code goes here
        }
    }
```

```
var child = new ChildClass();
            child.Property1 = 1;
            child.Property2 = "Foo";
            child.DoSomething(99);
```

S.O.L.I.D.

- Single Responsibility Principle
- Open-Closed Principle
- Liskov Substitution Principle
- Interface Segregation Principle
- Dependency Inversion Principle

Single Responsibility Principle

- A class should have one and only one reasons to change.

Single Responsibility Principle

```
public interface IEmployee
    {
        string FirstName { get; set; }
        string LastName { get; set; }
        float HourlyRate { get; set; }
        …

        float CalculatePay(float hoursWorked);
        string ReportHours();
        void Save();
    }
```

Single Responsibility Principle

```
public interface IEmployee
    {
        string FirstName { get; set; }
        string LastName { get; set; }
        float HourlyRate { get; set; }
        …
    }
```

```
public interface IDataAccess
{
  void Save();
}
```

```
public interface IReporting
{
  string ReportHours(
                Employee employee);
}
```

```
public interface IPayroll
{
    float CalculatePay(
                Employee employee,
                float hoursWorked);
}
```

Single Responsibility Principle

```
public class Employee : IEmployee
    {
        public string FirstName
             { get; set; }
        public string LastName
             { get; set; }
        public float HourlyRate
             { get; set; }
        …
    }
```

```
public class DataAccessSvc : IDataAccess
{
  public void Save(){ … }
}
```

```
public class ReportingSvc : IReporting
{
  public string ReportHours(
                  Employee employee) { … }
}
```

```
public class PayrollSvc : IPayroll
{
    public float CalculatePay(
                 Employee employee,
                 float hoursWorked) { … }
}
```

Open-Closed Principle

- Objects or entities should be
  - open for extension,
  - but closed for modification
- Add new behavior; don't change existing behavior

Open-Closed Principle Strategies

- Parameters
- Inheritance
- Composition / Strategy Pattern

Open-Closed Principle

```
public class Drawing
{
    public void DrawAllShapes(object[] shapes)
    {
        foreach (var shape in shapes)
        {
            if (shape is Circle)
            {
                var circle = (Circle)shape;
                DrawCircle(circle);
            }
            else if (shape is Square)
            {
                var square = (Square)shape;
                DrawSquare(square);
            }
        }
    }
}
```

Open-Closed Principle

```
public interface IShape
{
    void Draw();
}
```

```
public class Circle : IShape
{
    public int Radius { get; set; }
    public int CenterX { get; set; }
    public int CenterY { get; set; }

    public void Draw()
    {
        var center = new Tuple<int, int>
            (this.CenterX, this.CenterY);
        var radius = this.Radius;
    }
}
```

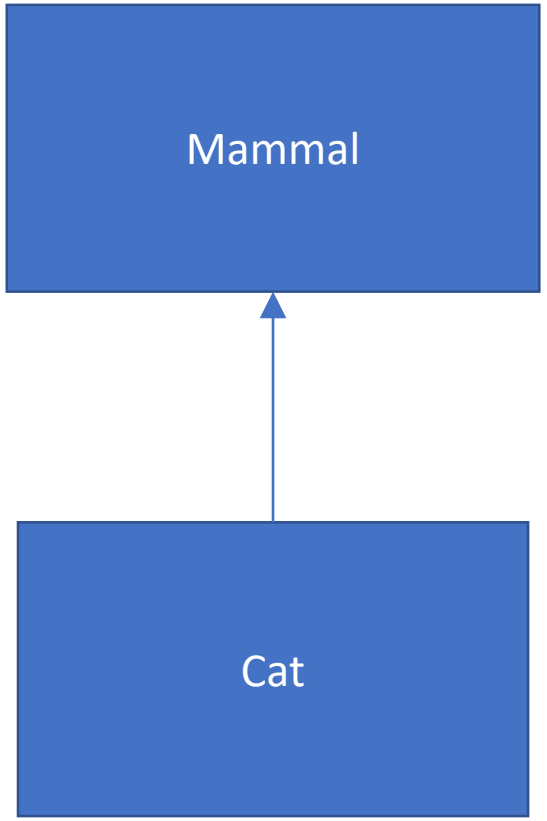
```
public class Square : IShape
{
    public int Side { get; set; }
    public int Top { get; set; }
    public int Left { get; set; }

    public void Draw()
    {
        var topLeft = new Tuple<int, int>
                        (this.Top, this.Left);
        var side = this.Side;
    }
}
```

Liskov Substitution Principle

- If something is true for the base class, it must be true for every derived class

Liskov Substitution Principle

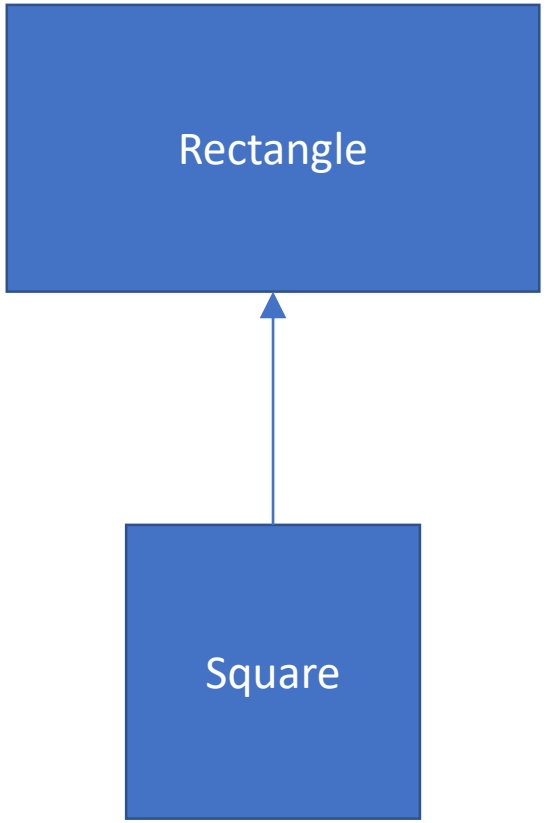


Inheritance

Cat is a Mammal

Cat inherits from Mammal

Liskov Substitution Principle



Inheritance

Square is a Rectangle

Square inherits from Rectangle

Liskov Substitution Principle

```
public class Rectangle
{
    public virtual int Height { get; set; }
    public virtual int Width { get; set; }
}
```

```
Rectangle r = new Square() { Height = 10, Width = 5 };
var area = r.Width * r.Height;
```

```
public class Square : Rectangle
{
    private int _width;
    private int _height;
    public override int Width
    {
        get { return _width; }
        set
        {
            _width = value;
            _height = value;
        }
    }

    public override int Height
    {
        get { return _height; }
        set
        {
            _height = value;
            _width = value;
        }
    }
}
```

Interface Segregation Principle

- A client should never be forced to implement and interface that it doesn't use

Interface Segregation Principle

```
interface IMachine
{
    void Print(List<Document> docs);
    void Staple(List<Document> docs);
    void Fax(List<Document> docs);
    void Scan(List<Document> docs);
    void PhotoCopy(List<Document> docs);
}
```

```
class Machine : IMachine
{
    public void Print(List<Document> docs)
    {
        // Print the items.
    }

    public void Staple(List<Document> docs)
    {
        // Staple the items.
    }

    public void Fax(List<Document> docs)
    {
        // Fax the items.
    }

    public void Scan(List<Document> docs)
    {
        // Scan the items.
    }

    public void PhotoCopy(List<Document> docs)
    {
        // Photocopy the items.
    }
}
```

From: https://www.codeproject.com/Tips/766045/Interface-Segregation-Principle-ISP-of-SOLID-in-Cs

Interface Segregation Principle

```
interface IMachine
{
    void Print(List<Document> docs);
    void Staple(List<Document> docs);
    void Fax(List<Document> docs);
    void Scan(List<Document> docs);
    void PhotoCopy(List<Document> docs);
}
```

```
class Printer : IMachine
{
    public void Print(List<Document> docs)
    {
        // Print the items.
    }

    public void Staple(List<Document> docs)
    {
      throw new NotImplementedException();
    }

    public void Fax(List<Document> docs)
    {
      throw new NotImplementedException();
    }

    public void Scan(List<Document> docs)
    {
        throw new NotImplementedException();.
    }
    public void PhotoCopy(List<Document> docs)
    {
        throw new NotImplementedException();
    }
}
```

Interface Segregation Principle

```
interface IPrinter
{
    void Print(List<Document> docs);
}
```

```
interface IScanner
{
    void Scan(List<Document> docs);
}
```

```
interface IStapler
{
    void Staple(List<Document> docs);
}
```

```
interface IFax
{
    void Fax(List<Document> docs);
}
```

```
interface IPhotocopier
{
    void PhotoCopy(List<Document> docs);
}
```

```
public class Printer : IPrinter
{
    public void Print(List<Document> docs)
    {
        // Print document
    }
}
```

Interface Segregation Principle

```
interface IPrinter
{
    void Print(List<Document> docs);
}
```

```
interface IScanner
{
    void Scan(List<Document> docs);
}
```

```
interface IStapler
{
    void Staple(List<Document> docs);
}
```

```
interface IFax
{
    void Fax(List<Document> docs);
}
```

```
interface IPhotocopier
{
    void PhotoCopy(List<Document> docs);
}
```

```
public class PrinterScannerCopier : IPrinter, IScanner, IPhotocopier
{
    public void PhotoCopy(List<Document> docs)
    {
        // Photocopy documents;
    }

    public void Print(List<Document> docs)
    {
        // Print documents
    }

    public void Scan(List<Document> docs)
    {
        // Scan documents
    }
}
```

Dependency Inversion Principle

- Entities must depend on abstractions, not on concrete implementations

Dependency Inversion Principle

```
var logger = new EventLogLogger();
logger.LogEvent(message, category);
```

```
var logger = new EventLogLogger();
logger.LogEvent(message, category);
```

Dependency Inversion Principle

```
public class LoggingService
    {
        private ILogger _logger = null;
        public LoggingService(ILogger logger)
        {
            _logger = logger;
        }

        public void LogEvent(string message, string category)
        {
            _logger.LogEvent(message, category);
        }
    }
```

```
var fileLogger = new FileLogger();
var logSvc = new After.LoggingService(fileLogger);
logSvc.LogEvent("This is an event", "Event");
```

References

- http://butunclebob.com/ArticleS.UncleBob.PrinciplesOfOod