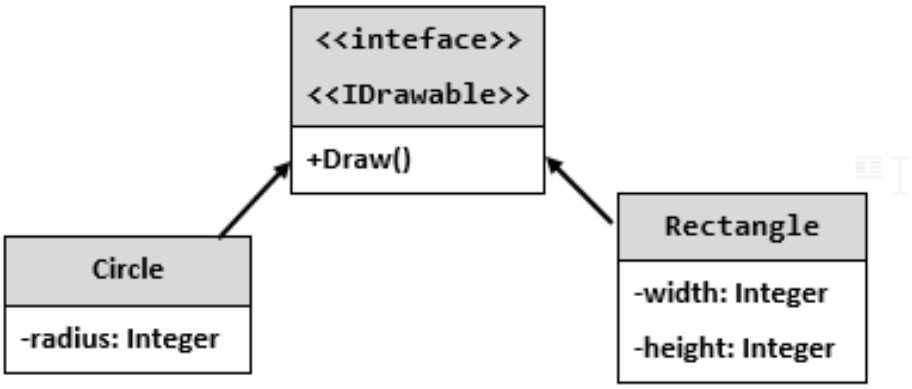
Lab: Abstraction and Polymorphism

Tasks for exercise in class and for homework to the course "Programming Advanced for QA" @ SoftUni.

Test your tasks in the Judge system: https://judge.softuni.org/Contests/4465/Abstraction-Polymorphism-Lab

1. Shapes

Build a **hierarchy** of **interfaces** and **classes**:



You should be able to use the class like this:

Program.cs

```
int radius = int.Parse(Console.ReadLine()!);
IDrawable circle = new Circle(radius);

int width = int.Parse(Console.ReadLine()!);
int height = int.Parse(Console.ReadLine()!);
IDrawable rectangle = new Rectangle(width, height);

circle.Draw();
rectangle.Draw();
```

Examples

Input	Output

3
4
5
	`   *******`
	` **       **`
	`**         **`
	`*           *`
	`**         **`
	` **       **`
	`   *******`
	`****`
	`*  *`
	`*  *`
	`*  *`
	`****`

Hints

The algorithm for drawing a circle is:

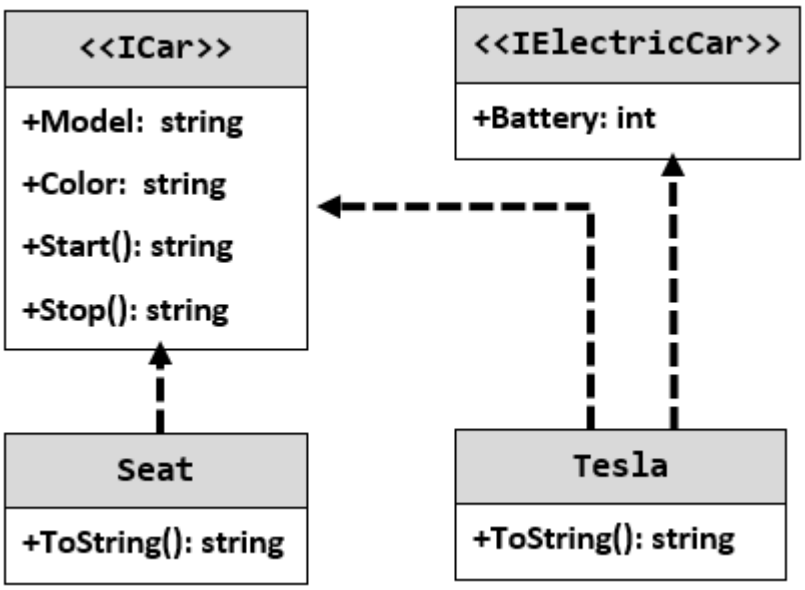
```
double rIn = this.radius - 0.4;
double rOut = this.radius + 0.4;
for (double y = this.radius; y >= -this.radius; --y)
{
    for (double x = -this.radius; x < rOut; x += 0.5)
    {
        double value = x * x + y * y;

        if (value >= rIn * rIn && value <= rOut * rOut)
        {
            Console.Write("*");
        }
        else
        {
            Console.Write(" ");
        }
    }
    Console.WriteLine();
}
```

The algorithm for drawing a rectangle is:

```
public void Draw()
{
    DrawLine(this.width, '*', '*');
    for (int i = 1; i < this.height - 1; ++i)
    {
        DrawLine(this.width, '*', ' ');
    }
    DrawLine(this.width, '*', '*');
}

private void DrawLine(int width, char end, char mid)
{
    Console.Write(end);
    for (int i = 1; i < width - 1; ++i)
    {
        Console.Write(mid);
    }
    Console.WriteLine(end);
}
```

2. Cars

Build a **hierarchy** of **interfaces** and **classes**:



Your hierarchy must be used with this code:

StartUp.cs

```
ICar seat = new Seat("Leon", "Grey");
ICar tesla = new Tesla("Model 3", "Red", 2);

Console.WriteLine(seat.ToString());
Console.WriteLine(tesla.ToString());
```

Examples

Output
Grey Seat Leon Engine start Break! Red Tesla Model 3 with 2 Batteries Engine start Break!

3. Animals

NOTE: You need a **folder** named **`Models`** to hold the **classes** in.

Create an **abstract** class **`Animal`**, which holds two fields:

- **`name`**: **string**
- **`favouriteFood`**: **string**

An animal has one **virtual method `ExplainSelf()`: `string`.**
You should add two new classes - **Cat** and **Dog. Override** the **`ExplainSelf()`** method by adding **concrete animal sound** on a new line. (Look at examples below)

You should be able to use the class like this:

Program.cs

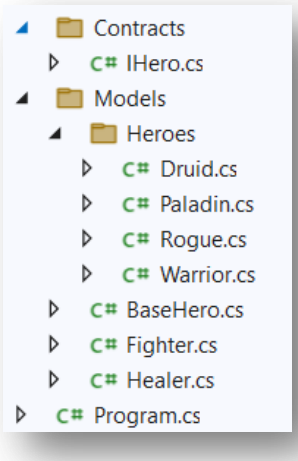
```
Animal cat = new Cat("Peter", "Whiskas");
Animal dog = new Dog("George", "Meat");

Console.WriteLine(cat.ExplainSelf());
Console.WriteLine(dog.ExplainSelf());
```

Examples

Output
I am Peter and my fovourite food is Whiskas MEEOW I am George and my fovourite food is Meat BORK

4. Raiding

Your task is to create a class hierarchy like the one shown here:



The **BaseHero** class should be **abstract** and inherit from **IHero**.

- **BaseHero – abstract – has string Name, abstract int Power, virtual string CastAbility(): {this.GetType().Name} - {this.Name}**
- **Fighter – abstract – inherits BaseHero, overrides CastAbility(): {base.CastAbility()} hit for {this.Power} damage**
- **Healer – abstract – inherits BaseHero, overrides CastAbility(): {base.CastAbility()} healed for {this.Power}**

Now create concrete classes:

- **Druid – inherits Healer, overrides power = 80, overrides CastAbility(): {base.CastAbility()}**
- **Paladin – inherits Healer, overrides power = 100, overrides CastAbility(): {base.CastAbility()}**
- **Rogue – inherits Fighter, overrides power = 80, overrides CastAbility(): {base.CastAbility()}**
- **Warrior – inherits Fighter, overrides power = 100, overrides CastAbility(): {base.CastAbility()}**

Example

Input	Output
3 Mike Paladin Josh Druid Scott Warrior 250	Paladin - Mike healed for 100 Druid - Josh healed for 80 Warrior - Scott hit for 100 damage Victory!
2 Mike Warrior Tom Rogue 200	Warrior - Mike hit for 100 damage Rogue - Tom hit for 80 damage Defeat...