# Tutorial of Class and Object (Basic)

> Based on the tutorial of "2020S-Java-A" designed by teaching group in SUSTech
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> Modified (mainly change to markdown file) by ZHU Yueming in 2021. March. 29th
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> Improved Exercise 1 and add part 2 by ZHU Yueming in 2023. Oct. 22th

## Experimental Objective

- Learn how to define a Java class and create its object
- Learn how to define and use instance variables
- Learn how to define and use instance methods
- Learn how to use get and set methods
- Learn passing value by arguments from main method

## Part1 Class and Object

### Before Exercise

#### Attribute and Method

**Step 1: How to define a circle on 2 dimensional plane?**

A circle has three attributes including the **radius**, the **x** *coordinate* and the **y** *coordinate*.

We can define a class named `Circle`, in which there are three private attributes.

```
public class Circle {
  private double radius;
  private double x;
  private double y;
}
```

**Step 2: Define the methods of a circle.**

Define three public methods for computing the area, perimeter and print position of the circle.

```
public class Circle {
  private double radius;
  private double x;
```

```
  private double y;

  public double area() {
    return radius*radius*Math.PI;
  }
  public double perimeter () {
    return 2*Math.PI*radius;
  }
  public void position() {
    System.out.printf("Position of the cricle is (%.1f,%.1f)\n",x,y);
  }
}
```

**Step 3: How to use the class Circle?**

Create another class named `CircleTest` in the same package, in which there is a main method to be used.

In the main method, we can create an object of `Circle` by using the statement as follows:

```
Circle c1=new Circle();
```

After that, we want to know the perimeter, area and position about the `c1`, so we need to invoke the method of `c1`.

```
public class CircleTest {
  public static void main(String[] args) {
    Circle c1=new Circle();
    System.out.printf("The area of c1 is %.2f\n", c1.area());
    System.out.printf("The perimeter of c1 is %.2f\n", c1.perimeter());
    c1.position();
  }
}
```

When we run the program, the result would as follows:

```
The area of c1 is 0.00
The perimeter of c1 is 0.00
Position of the circle is (0.0,0.0)
```

## Getter and Setter

**Step 4: Set and get the values of the attributes**

If we set or get the radius of a circle object in main method directly, it would lead to an error because of its private privilege.

In addition, the radius of a circle should not contain a negative number, how can we set the restriction?

```
public static void main(String[] args) {
    Circle c1=new Circle();
    System.out.printf("The area of c1 is %.2f\n", c1.area());
    System.out.printf("The perimeter of c1 is %.2f\n", c1.perimeter());
    c1.position();
      c1.radius=-1;
      System.out.println(c1.radius);
  }
```

We can define several public methods in class Circle for getting or setting the class variables, and we can check the validity of input value in the set method.

```
public class Circle {
  private double radius;
  private double x;
  private double y;

  public double area() {
    return radius*radius*Math.PI;
  }
  public double perimeter () {
    return 2*Math.PI*radius;
  }
  public void position() {
    System.out.printf("Position of the cricle is (%.1f,%.1f)\n",x,y);
  }
  public double getRadius() {
    return radius;
  }
  public void setRadius(double radius) {
    if (radius > 0) {
      this.radius = radius;
    }
  }
  public double getX() {
    return x;
  }
  public void setX(double x) {
    this.x = x;
  }
  public double getY() {
    return y;
  }
  public void setY(double y) {
    this.y = y;
  }
}
```

After that, we can access the attributes by the get and set methods.

```
public static void main(String[] args) {
    Circle c1=new Circle();

    c1.setRadius(5);
    System.out.println(c1.getRadius());

    System.out.printf("The area of c1 is %.2f\n", c1.area());
    System.out.printf("The perimeter of c1 is %.2f\n", c1.perimeter());
    c1.position();

  }
```

Sample output:

```
5.0
The area of c1 is 78.54
The perimeter of c1 is 31.42
Position of the circle is (0.0,0.0)
```

# Exercise

## Exercise 1 : User

Declare a class named **User**. The class contains:

- Private data fields:

  String **account;**

  **String password**;

  **double money**;

- Implement a public method named **introduce()** to print the user account and his account balance.

  Output:

  ```
  [account]'s account has a balance of [money] dollar
  ```

- Implement a public method **expense(double value,Scanner in)**.
  - **Check whether suffice the funds**.

    If money is not enough, output:

    ```
    Plan to expense [value] dollar but no sufficient funds
    ```

    If money is enough, output:

```
Plan to expense [value] dollar
Please input your password:
```

- **Input password**, and check password in three times, if the password is wrong, terminate the program.

  For example:

  ```
  password error,there are 2 times left to try
  ```

- **Expense**:

  output:

  ```
  Expense [value] dollar and balance [updated money] dollar
  ```

- Implement a public method **income(double value).** It deposits the money to the user account.

  Output:

  ```
  Got [value] as income,balance is [updated money] dollar
  ```

- Implement the **getter** and **setter** methods for each private field of the class User.

In the same package, we create a class named `UserTest`, which has a main method.

```
User user =new User();
Scanner in = new Scanner(System.in);
user.setUser("Lucy");
user.setPassword("123456");
user.setMoney(1000);
user.introduce();
user.expense(2000,in);
user.expense(500,in);
user.income(1000);
user.introduce();
in.close();
```

Sample Output 1:

```
Lucy's account has a balance of 1000.00 dollar
Plan to expense 2000.00 dollar but no sufficient funds
Plan to expense 500.00 dollar
Please input your password:
12345
password error,there are 2 times left to try
Please input your password:
```

```
12345
password error,there are 1 times left to try
Please input your password:
12345
password error,there are 0 times left to try
password error,expense failed
Got 1000.00 as income,balance is 2000.00 dollar
Lucy's account has a balance of 2000.00 dollar
```

Sample Output 2:

```
Lucy's account has a balance of 1000.00 dollar
Plan to expense 2000.00 dollar but no sufficient funds
Plan to expense 500.00 dollar
Please input your password:
123456
Expense 500.00 dollar and balance 500.00 dollar
Got 1000.00 as income,balance is 1500.00 dollar
Lucy's account has a balance of 1500.00 dollar
```

## Exercise 2 : Food

Design a class named **Food**. The class contains:

- Private data fields:

  int **id;**

  String **name;**

  String **type**;

  int **size**;

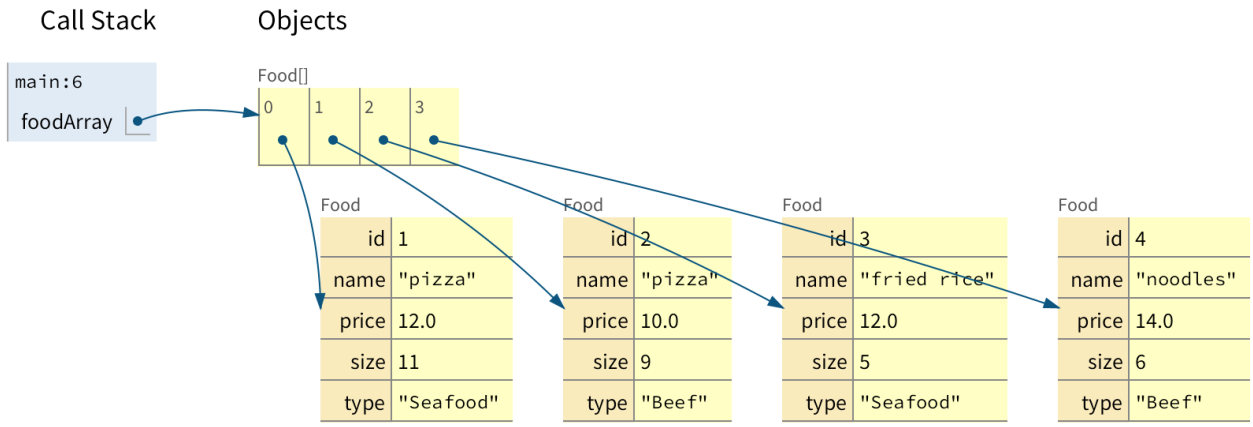
  double **price;**
- Implement a public method named `getMenu()` to print all the information of this food object.
- Implement the **getter** and **setter** method for each private field of Food.

In `FoodTest` class, create four objects of Food as follows:

| Object Name | id | name | type | size | price |
|---|---|---|---|---|---|
| **pizza1** | 1 | pizza | Seafood | 11 | 12 |
| **pizza2** | 2 | pizza | Beef | 9 | 10 |
| **Fried rice** | 3 | fried rice | Seafood | 5 | 12 |
| **Noodles** | 4 | noodles | Beef | 6 | 14 |

Create an `Food[]` to add those four Food objects, and then show the information of them as follows by iterating the `Food[]` we created.

```
Seafood pizza: (11 Inches) 120.00 $
Beef pizza: (9 Inches) 100.00 $
Seafood fried rice: (5 Inches) 40.00 $
Beef noodle: (6 Inches) 35.00 $
```




# Part2 Input value by passing arguments from main method:

## Example Exercise:

According to the cricle class we introduce before, try the following main method:

```
public class CircleTestArgs {
    public static void main(String[] args) {
        Circle c = new Circle();
        c.setRadius(Double.parseDouble(args[0]));
        c.setX(Double.parseDouble(args[1]));
        c.setY(Double.parseDouble(args[2]));
        System.out.printf("Circle: [%.1f,%.1f] area = %.1f perimeter = %.1f\n"
                ,c.getX(),c.getY(), c.area(), c.perimeter());
    }
}
```

## By Intellij IDEA:

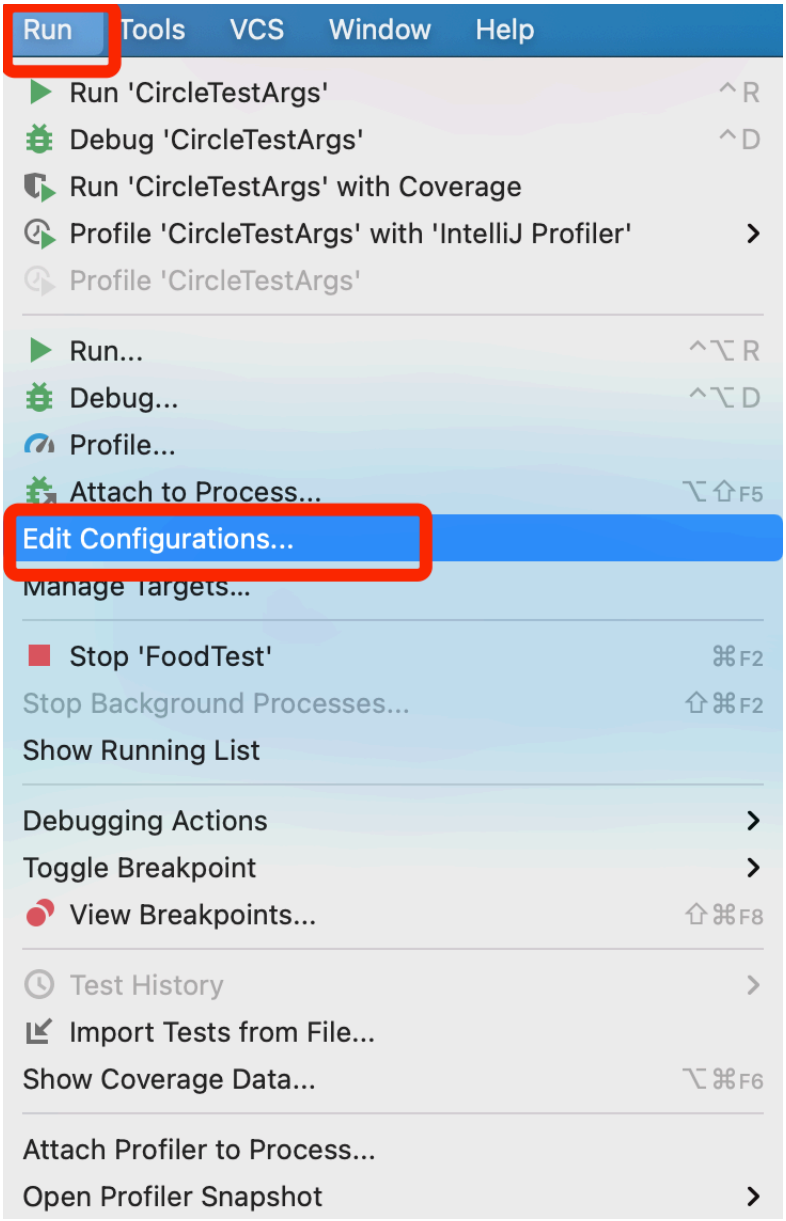
**generate .class file** : If we run the program by Intellij IDEA, a .class file about this main method will be created, but it will return :

```
Exception in thread "main" java.lang.ArrayIndexOutOfBoundsException: Index 0
out of bounds for length 0
  at CircleTestArgs.main(CircleTestArgs.java:4)
```

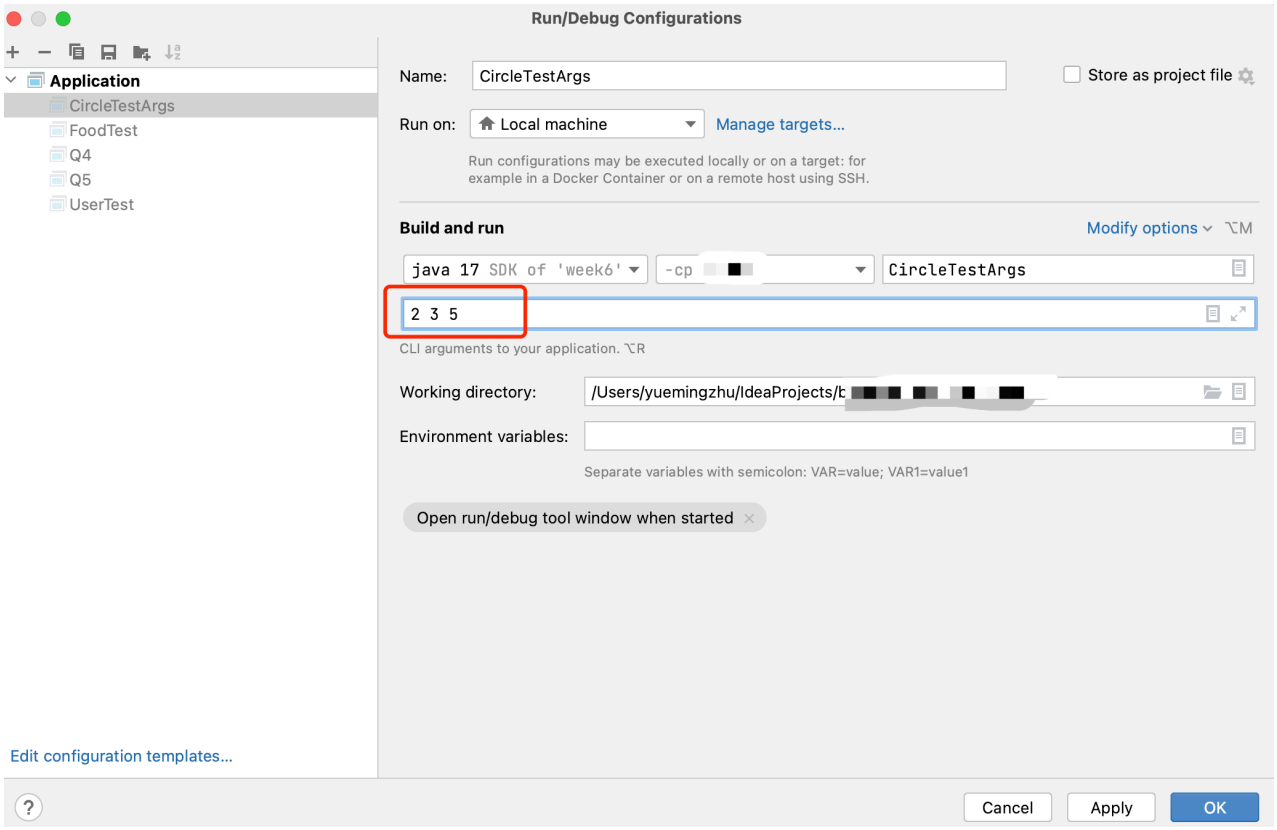
It is before we haven't set the arguments.

**Set arguments**:

Click run -> Edit Configurations




Input arguments:




Then it will return :

```
Circle: [3.0,5.0] area = 12.6 perimeter = 12.6
```

# By Command Line:

Open your terminal and then try:

```
(base) yuemingzhu@YUEMINGs-MacBook-Air src % javac CircleTestArgs.java
(base) yuemingzhu@YUEMINGs-MacBook-Air src % java CircleTestArgs 2 3 5
```

If will return

```
Circle: [3.0,5.0] area = 12.6 perimeter = 12.6
```