Java
Lecture 3 –

IT Learning &
Outsourcing Center

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Contents

- Object Oriented Programming (OOP)
- Classes and objects
- Fields
- Manipulating object state
- Using methods
- Introduction to Strings

Object Oriented Programming

- OOP is concept in programming
- It enable software engineers to write reusable, easy for understanding and maintaining code
- The heart of OOP consist of objects and classes

Objects

- Software objects are used to model the real-world and abstract objects that you find in everyday life

Objects

- Real-world objects share two characteristics: They all have state and behavior

Objects - state

Each person has name, age, personal number... (state)

Objects - behavior

Each person can eat, sleep, walk... (behavior)

Objects

- Mobile phone
  - Has memory
  - Has color
  - is switched on / off
  - can ring
  - can send SMS
  - can be switched on / off

Objects

- Mobile phone
  - is indestructible
  - can hammer nails

Classes

- The class acts as the template for building object
- The class defines the properties of the object and its behavior

Person example

Every human:

- Has name
- Has age
- Has personal number
- Has sex
- Has weight

Person example

IVAN

- 25 YEARS OLD
- P.N. 8612025281
- IS MALE
- 80.5 KG

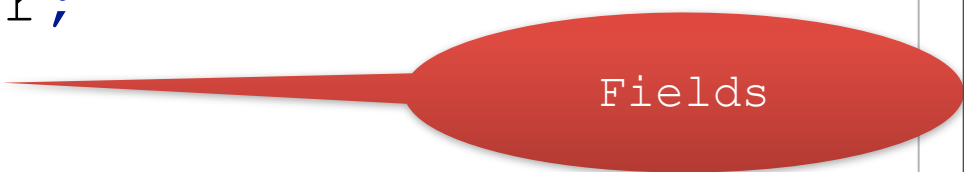
Maria

- 21 years old
- p.n. 8203301201
- is female
- 55.0 kg

Writing simple classes

- Each starts with *class <name of the class>*
- The properties are called fields. They hold the state of each object
- The fields has type and name

```
public class Person {
      String name;
      int age;
      long personalNumber;
      boolean isWoman;
      double weight;
}
```



Objects in Java

- Objects are the presentation of a class
- Each class can have more than one object instances
- Objects of same classes have the same properties, but they may differ by the values of these properties
- Objects exists in heap memory
- Objects can be created and their state can be changed

Creating objects of class Person

- A variable of type Person should be declared
- Objects are created via constructors (we'll talk more about them in the next lesson)
- Using keyword *new*

```
public class PersonTest {

	public static void main(String[] args) {
		Person ivan = new Person();
		Person maria = new Person();
	}
}
```

Differences between classes and objects

- Object is the concrete representation of a class.
- Class is the „model“ for creating an object
- Each object has the properties that its class owns
- Objects have the same properties, but they may differ by the values of these properties
- One class can have more than one objects, but an object can't be instance of more than one class

More on classes

- Each class begins with a capital letter and use CamelCase convention
- Each class has the same name as the file it is declared in
- The programmer creates the classes in a file .java, Java compiles .java-files and creates .classes
- .java is human-readable, .class is machine-readable

Accessing fields and modifying the state of the object

- <object>.<fieldname> is used to access fields

```
public static void main(String[] args) {

        Person ivan = new Person();
        ivan.name = "Ivan";
        ivan.age = 25;
        ivan.isWoman = false;
        ivan.personalNumber = 861202528;
        ivan.weight = 80.5;

        System.out.print("Ivan is " + ivan.age + "
years old ");
        System.out.print("and his weight is " +
ivan.weight);
}
```

Accessing field with .

Accessing fields and modifying the state of the object

- Getters / Setters

```
public static void main(String[] args) {

        Person ivan = new Person();
        ivan.setName("Ivan");
        ivan.setAge(25);
        ivan.setIsWoman(false);
        ivan.setPersonalNumber(861202528);
        ivan.setWeight(80.5);

        System.out.print("Ivan is " + ivan.getAge() + "
years old ");
        System.out.print("and his weight is " +
ivan.getWeight());
}
```

Car Example

Let's write class which represents Car

Each car has:

- Max speed
- Current speed
- Color
- Current gear

Car Example

1. Write the class Car

2. Create class CarDemo with main method

3. Create 2 instances of class car and set values to their fields

4. Change the gear and current speed of one of the cars

Car driver/owner

- We want every car to have owner.
- The owner is a person

1. Make some changes to class Car to assign owner to every car

2. In CarDemo print to the console the name of the owner for every car n.

Add friend to class Person

- Each person has a friend, who is a person as well.
- Friend is a field of type Person in class Person.
- *There is no problem for a class to have an instance of itself*

Methods

- Methods are features of the object
- Can manipulate the data of a specified object
- Can perform any other task
- Have name
- Have body, enclosed between braces { } – code
- Have parameters
- Have return type (for now we'll use only void)

```
<return type> <method name> (<parameters>) {
        <body>
}
```

Methods in class Person

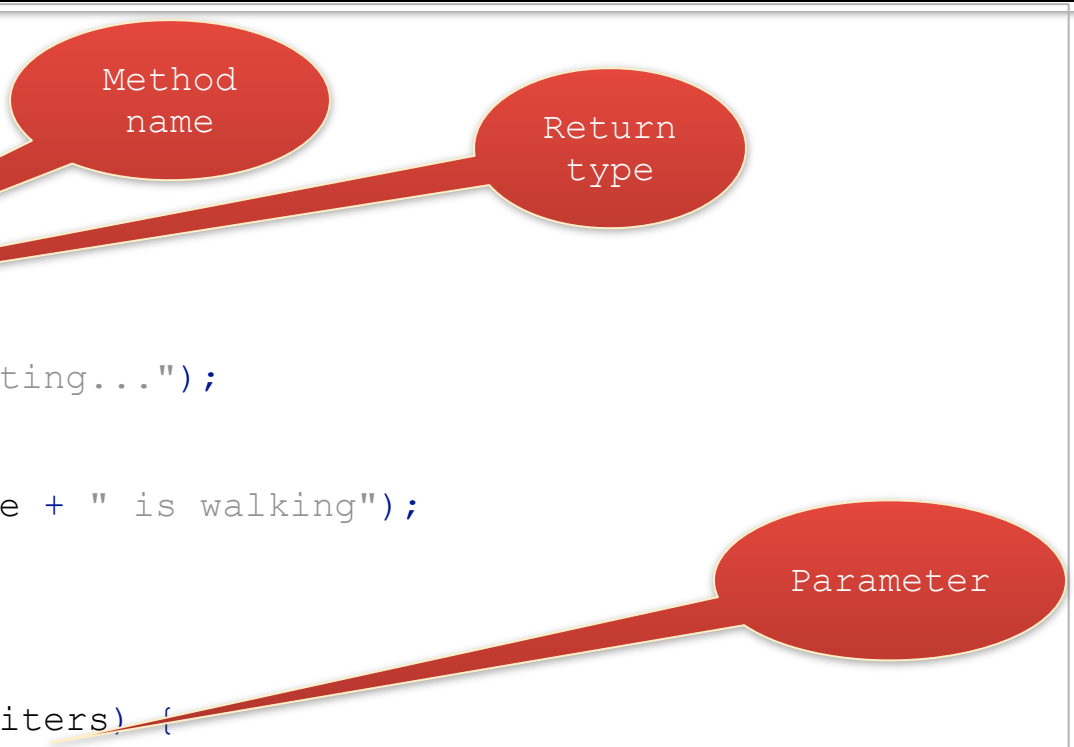
Each human eat food, can walk, can drink water and increase his age every year.

- eat ()
- walk()
- growUp() - modify the field age
- drinkWater(double liters)

Methods in class Person


```
public class Person {
        String name;
        int age;
        long personalNumber;
        boolean isWoman;
        double weight;

        void eat() {
          System.out.println("Eating...");
        }
        void walk() {
          System.out.println(name + " is walking");
        }
        void growUp() {
          age++;
        }
        void drinkWater(double liters) {
          if(liters > 1) {
            System.out.println("This is too much water!!!");
          } else {
            System.out.println(name + " is drinking " + liters + " water.");
          }
        }
}
```



Calling methods

- (non static) methods are called by instance of the class using .
- *<instance>.<method name>(<parameters list>);*

```
public static void main(String[] args) {
        Person ivan = new Person();
        ivan.name = "Ivan";
        ivan.age = 25;
        ivan.isWoman = false;
        ivan.personalNumber = 861202528;
        ivan.weight = 80.5;

        ivan.walk();
        double literWater = 0.3;
        ivan.drinkWater(literWater);
}
```

Exercise

- Add methods in class Car:

```
void accelerate()
void changeGearUp()
void changeGearDown()
void changeGear(int nextGear)
void changeColor(String newColor)
```

- Write logic in methods which change gear (validate the gear before changing - min is 1, max is 5)
- Invoke them in CarDemo class

Methods in class Car


```
void changeGearUp() {
       if(gear < 5) {
         gear++;
       }
}
void changeGearDown() {
       if(gear > 0 ) {
         gear--;
       } else {
         System.out.println("You are now on 1st gear!!!);
       }
}
void changeGear(int nextGear) {
       if(nextGear > 0 && nextGear < 6) {
         gear = nextGear;
       }
}
void changeColor(String newColor) {
       color = newColor;
}
```

Calling the methods of class Car


```
public static void main(String[] args) {
        Car golf = new Car();
        golf.speed = 100;
        golf.color = "Red";
        golf.gear = 5;
        golf.maxSpeed = 320.5;

        Car honda = new Car();
        honda.gear = 5;
        honda.changeGearUp();

        System.out.println("The current speed of the golf is " + golf.speed);
        golf.accelerate();
        System.out.println("The current speed of the golf is " + golf.speed);

        System.out.println("The current gear is " + golf.gear);
        for (int i = 0; i < 10; i++) {
                golf.changeGearUp();
        }
        System.out.println("The current gear is " + golf.gear);

        System.out.println("The Honda's current gear is " + honda.gear);
        honda.changeGear(1);
        System.out.println("The Honda's current gear is " + honda.gear);

        golf.changeColor("Blue");
        golf.changeColor("Red");
}
```

Strings

- What is String?
- How to create a String

Declare variable of type String

Initialization

```
String firstName;

firstName = "Ivan";

String lastName = new String("Petrov");
```

Another way for initialization

Concatenation of strings

```
String firstName = "Ivan";

String lastName = "Petrov";

String name = firstName + " " + lastName;

System.out.println(name);
```

+ is used for concatenation

Prints the value of name in the console

Comparing strings

- .equals() should be used because String is reference type

```
String firstName = "Ivan";
String lastName = "Petrov";

String name = firstName + " " + lastName;

System.out.println(name == "Ivan Petrov");
System.out.println(name.equals("Ivan Petrov"));
```

- The output is:
  false
  true

More about Strings

- \ should be used for escaping special characters
- .length() return the length of the string
- String has many features(methods) for manipulating the text value

```
String welcome = "Welcome to learning center
\"Pragmatic\"";

System.out.println(welcome.length());
```

The output is 38

Converting Strings to Numbers

- The Number subclasses that wrap primitive numeric types (Byte, Integer, Double, Float, Long, and Short) each provide a class method named valueOf that converts a string to an object of that type.

- **Note:** Each of the Number subclasses that wrap primitive numeric types also provides a parseXXXX() method (for example, parseFloat()) that can be used to convert strings to primitive numbers.

- StringValueOfDemo.java in the code examples

Converting Numbers to Strings

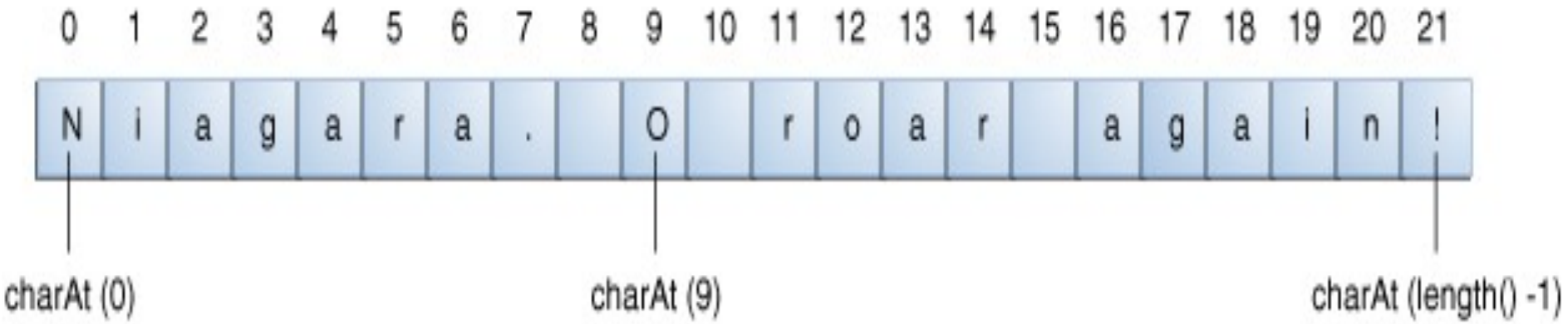

```
int i;
// Concatenate "i" with an empty string;
// conversion is handled for you.
 String s1 = "" + i;
```

```
// The valueOf class method.
String s2 = String.valueOf(i);
```

- …or using the toString() method – check ToStringDemo.java in code examples

Getting Characters and Substrings by Index (part 1)

- You can get the character at a particular index within a string by invoking the charAt() accessor method. The index of the first character is 0, while the index of the last character is length()-1.



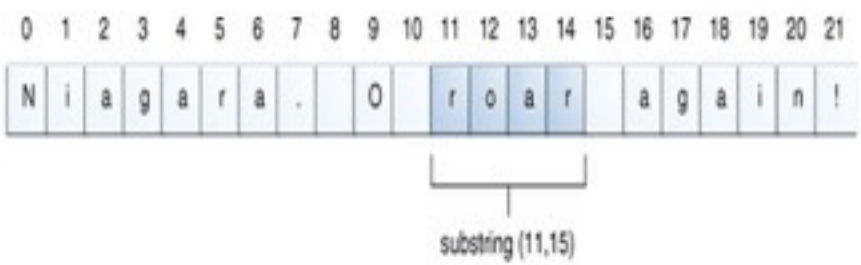
Getting Characters and Substrings by Index (part 2)

The `substring` Methods in the `String` Class

Method	Description
`String substring(int beginIndex, int endIndex)`	Returns a new string that is a substring of this string. The first integer argument specifies the index of the first character. The second integer argument is the index of the last character - 1.
`String substring(int beginIndex)`	Returns a new string that is a substring of this string. The integer argument specifies the index of the first character. Here, the returned substring extends to the end of the original string.

The following code gets from the Niagara palindrome the substring that extends from index 11 up to, but not including, index 15, which is the word "roar":

```
String anotherPalindrome = "Niagara. O roar again!";
String roar = anotherPalindrome.substring(11, 15);
```



Other Methods for Manipulating Strings

- trim() - Returns a copy of this string with leading and trailing white space removed.
- toLowerCase() or toUpperCase() - Returns a copy of this string converted to lowercase or uppercase. If no conversions are necessary, these methods return the original string.
- The indexOf() methods search forward from the beginning of the string, and the lastIndexOf() methods search backward from the end of the string. If a character or substring is not found, indexOf() and lastIndexOf() return -1.

More methods for comparing Strings

Methods for Comparing Strings

Method	Description
`boolean endsWith(String suffix)` `boolean startsWith(String prefix)`	Returns `true` if this string ends with or begins with the substring specified as an argument to the method.
`boolean startsWith(String prefix, int offset)`	Considers the string beginning at the index `offset`, and returns `true` if it begins with the substring specified as an argument.
`int compareTo(String anotherString)`	Compares two strings lexicographically. Returns an integer indicating whether this string is greater than (result is > 0), equal to (result is = 0), or less than (result is < 0) the argument.
`int compareToIgnoreCase(String str)`	Compares two strings lexicographically, ignoring differences in case. Returns an integer indicating whether this string is greater than (result is > 0), equal to (result is = 0), or less than (result is < 0) the argument.
`boolean equals(Object anObject)`	Returns `true` if and only if the argument is a `String` object that represents the same sequence of characters as this object.
`boolean equalsIgnoreCase(String anotherString)`	Returns `true` if and only if the argument is a `String` object that represents the same sequence of characters as this object, ignoring differences in case.

Summary

- What is String and how we can to use it?
- What is a class?
- What is an object?
- What's the differences between classes and object
- How to declare property of a class
- Use objects as fields
- How to create an object
- How to declare and call methods