Test Automation Lecture 4 – Objects in memory, Constructors, Passing & Returning value from methods

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Objects in memory

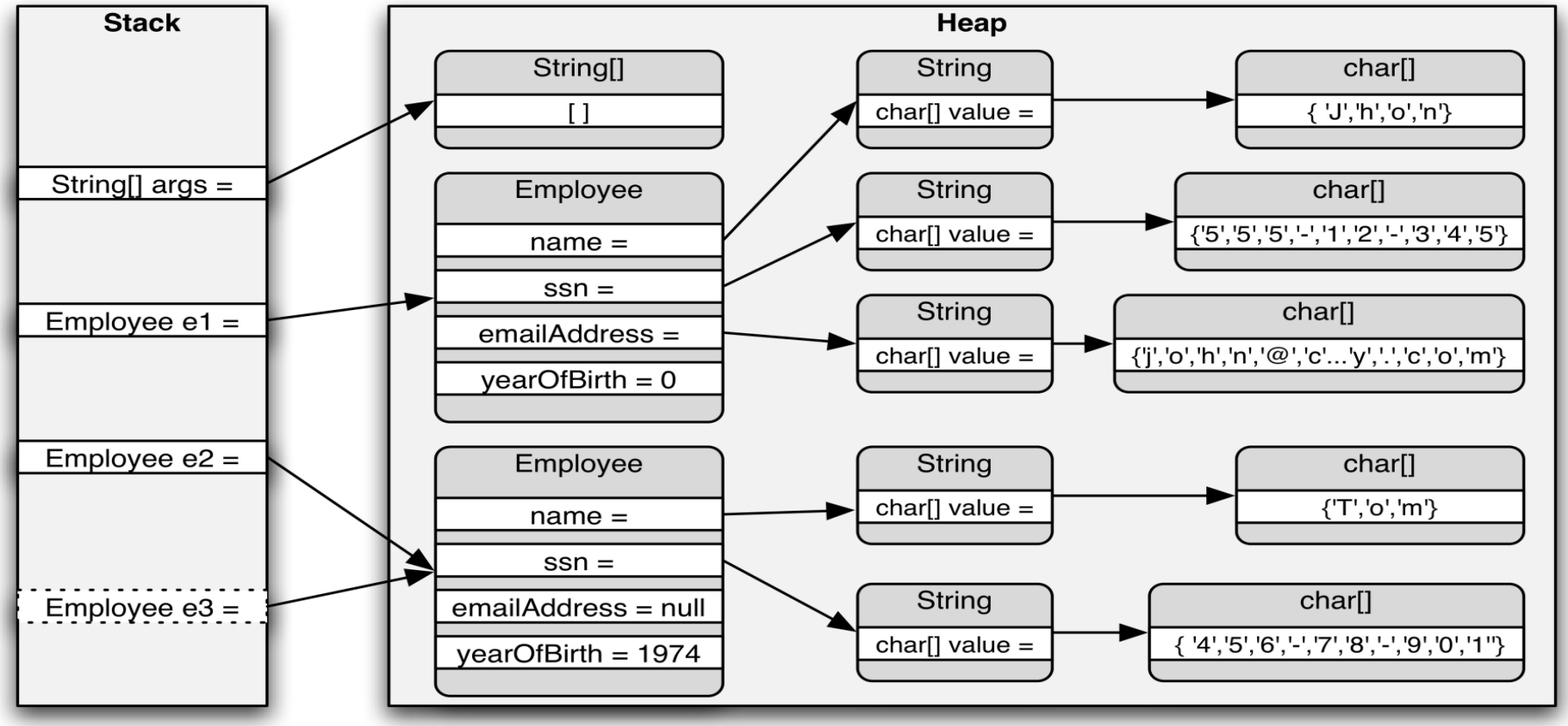
- There are two types of memory in Java – static and dynamic (heap)
- Primitives are stored into the static memory
- Objects are reference data types and are stored into the heap
- The reference to the object is kept in the static memory
- The phrase "*instantiating a class*" means the same thing as "*creating an object*." When you create an object, you are creating an "*instance*" of a class, therefore "*instantiating*" a class.

Objects in memory

- Objects are created via constructors - operator new allocates memory in the heap
- The Garbage collector destroys the unused objects – clears the heap
- The destruction of objects is not a programmer task – the garbage collector does it for you

Objects in memory

- Picture of memory



Objects - Nothing created in memory

- `int height = new Rectangle().height;`

- This statement creates a new Rectangle object and immediately gets its height. In essence, the statement calculates the default height of a Rectangle. Note that after this statement has been executed, the program no longer has a reference to the created Rectangle, because the program never stored the reference anywhere. The object is unreferenced, and its resources are free to be recycled by the Java Virtual Machine.

- The rectangle class can be seen under Rectangle.java in code examples

References

- Objects are referent types
- Primitives are not referent types
- Dealing with objects is always dealing with its reference
- Declaration of an object creates a reference but it points to nothing – i.e. null

References

- Using = with objects deals only with the reference

```
Person mitko;
Person joro = new Person(18,"Georgi");
mitko = joro;
mitko.age = 21;
System.out.println(joro.age);
```

What is going to be the console output?

```
Person joro = new Person(18,"Georgi");
Person mitko = new Person(20,"Dimitar");
mitko = joro;
```

What happens with {20, Dimitar}?

Constructor

- Constructor is responsible for creating an object
- You can recognize a constructor because its declaration uses the same name as the class and it has no return type – it should always return the newly created object
- To constructors we can pass parameters
- Constructors should have a body
- Constructors are always named to the class name

Constructor

- Constructors examples

```
Person() {

}

Person(int ageParam, String nameParam) {
      age = ageParam;
      name = nameParam;
}
```

Default constructor

Constructor with parameters for age and name

Car, Person Example

We will start writing example with Car and Person (the classes from the previous lesson)

1. First start with adding the fields price and isSportCar to the class Car

2. Write constructor in class Car:

```
Car(String modelParam, boolean
  isSportCarParam, String colorParam)
```

it sets the parameter to the fields and set default values to currentSpeed and gear

Keyword this

- this always refers to the current object
- Using this in constructors is good practice

```
public class Person {
	int age;
	String name;

	Person(int age, String name){
		this.age = age;
		this.name = name;
	}
}
```

In the case above, sing this is obligatory. If this is not used, the scope of age and name is restricted only for the constructor i.e when referencing them, we reference the passed parameters but not the fields

Car, Person Example

In constructor

```
Car(String model, boolean isSportCar, String
  color)
```

3. Use *this* and change the parameters' names as shown above

More about constructors

- Default constructor - a constructor without parameters
- Default constructor is always available if no other constructors are defined
- Each class can have more than one constructor
- If a constructor with parameters is defined, the default constructor is not available
- The constructors can be invoked in the body of another constructor

More about constructors


```
public class Person {
	int age;
	String name;
	double height;

	Person(){}

	Person(int age){
		this();
		this.age = age;
	}
	Person(int age, String name){
		this(age);
		this.name = name;
	}
	Person(int age, String name, double height){
		this(age, name);
		this.height = height;
	}
}
```

This constructor uses the default one

This constructor uses another constructor which uses the default one

Car, Person Example

4. Write constructor in class Car:

```
Car(String model, boolean isSportCar, String
  color, double price, double maxSpeed)
```

it calls the other constructor and then set the other parameters to the fields. It also checks if the car is sport before setting its maxSpeed to more than 200

Car, Person Example

In class Person add 2 constructors:

5. Default constructor - it sets age to 0 and weight to 4.0

   Change class Person to contain array of Friends instead of one friend

6. `Person(String name, long personalNumber, boolean isMale)`

   it calls the default constructor first, then set the values and initialize the friends array with new array with 3 elements

Car, Person Example

7. Create class Demo with main method and test the constructors of class Car and Person

Methods - declaration

- return type (boolean, int, String, <any other class>)
- Method name (starts with lowerCase, use CamelCase convention)
- Brackets (mandatory)
- List with parameters in the brackets (not mandatory)
- Body – starts with { and ends with }
- *Parameters* refers to the list of variables in a method declaration.
- *Arguments* are the actual values that are passed in when the method is invoked. When you invoke a method, the arguments used must match the declaration's parameters in type and order.
- The Java programming language doesn't let you pass methods into methods. But you can pass an object into a method and then invoke the object's methods.

Method - parameter names

- When you declare a parameter to a method or a constructor, you provide a name for that parameter. This name is used within the method body to refer to the passed-in argument.

- The name of a parameter must be unique in its scope. It cannot be the same as the name of another parameter for the same method or constructor, and it cannot be the name of a local variable within the method or constructor.

Returning a Value from a Method (part 1)

- A method returns to the code that invoked it when it
  - completes all the statements in the method,
  - reaches a return statement, or
  - throws an exception (covered later)
- whichever occurs first.

Returning a Value from a Method (part 2)

- You declare a method's return type in its method declaration. Within the body of the method, you use the return statement to return the value.

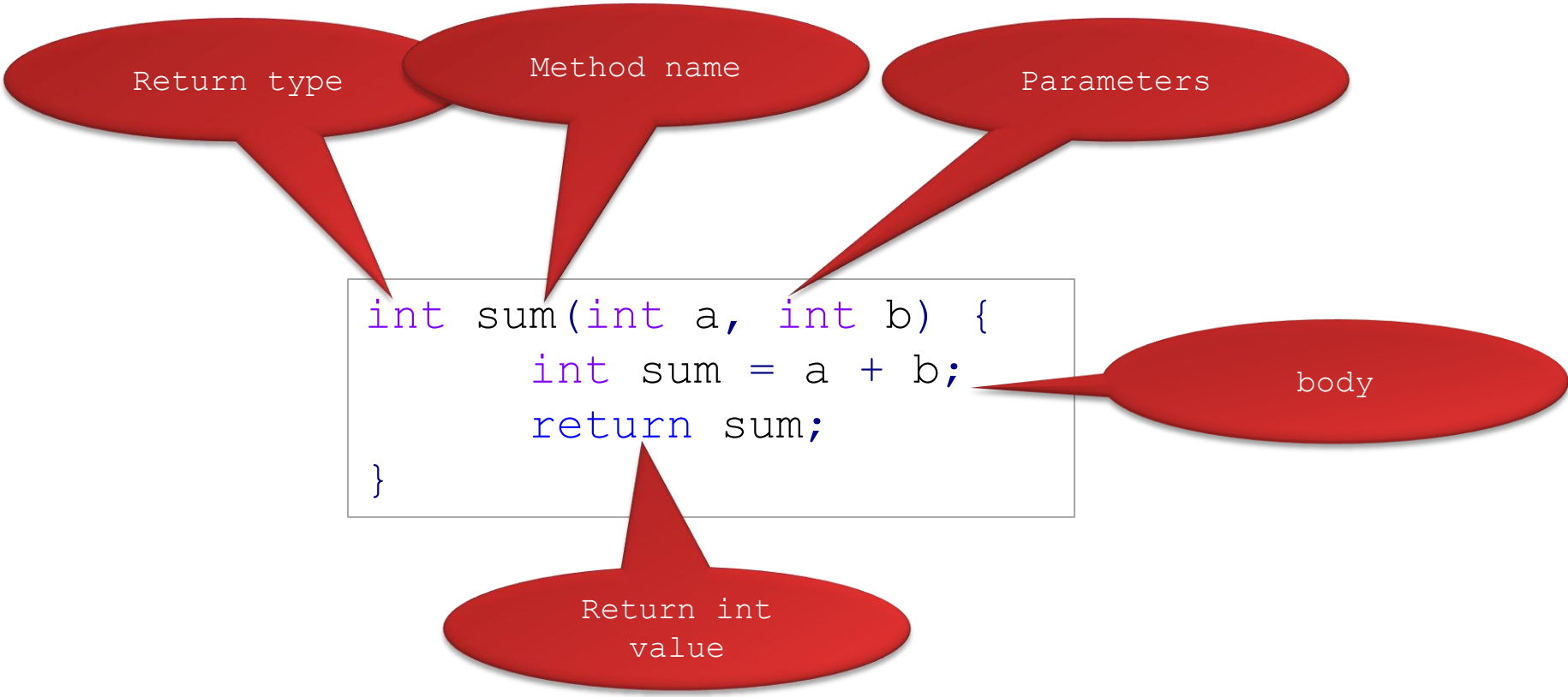
- Any method declared void doesn't return a value. It does not need to contain a return statement, but it may do so. In such a case, a return statement can be used to branch out of a control flow block and exit the method and is simply used like this:
  - return;

Returning a Value from a Method (part 3)

- If you try to return a value from a method that is declared void, you will get a compiler error.

- Any method that is not declared void must contain a return statement with a corresponding return value, like this:
  - return returnValue;
  - The data type of the return value must match the method's declared return type; you can't return an integer value from a method declared to return a boolean.

Example of method with returned type int



Returning a Value from a Method (part 4)

- Returning a primitive type example:

```
// a method for computing the area of the rectangle
    public int getArea() {
        return width * height;
    }
```

- Returning reference type example:

```
public Bicycle seeWhosFastest(Bicycle myBike, Bicycle yourBike,
                              Environment env) {
    Bicycle fastest;
    // code to calculate which bike is
    // faster, given each bike's gear
    // and cadence and given the
    // environment (terrain and wind)
    return fastest;
}
```

Passing Primitive Data Type Arguments (part 1)

- Primitive arguments, such as an *int* or a *double*, are passed into methods *by value*. This means that any changes to the values of the parameters exist only within the scope of the method. When the method returns, the parameters are gone and any changes to them are lost. Here is an example:

Passing Primitive Data Type Arguments (part 2)


```
public class PassPrimitiveByValue {

    public static void main(String[] args) {

        int x = 3;

        // invoke passMethod() with
        // x as argument
        passMethod(x);

        // print x to see if its
        // value has changed
        System.out.println("After invoking passMethod, x = " + x);

    }

    // change parameter in passMethod()
    public static void passMethod(int p) {
        p = 10;
    }
}
```

After invoking passMethod, still x = 3

Passing Reference Data Type Arguments (part 1)

- Reference data type parameters, such as objects, are also passed into methods *by value*. This means that when the method returns, the passed-in reference still references the same object as before. *However*, the values of the object's fields *can* be changed in the method, if they have the proper access level.

- Here is an example:

Passing Primitive Data Type Arguments (part 2)


```
public class PassReferentByValue {

    public static void main(String[] args) {
        Person ivan = new Person("Ivan");

        // invoke passMethod() with
        // ivan as argument
        passMethod(ivan);

        // print ivan.name to see if its value has changed?
        // YES it changes, but the reference ivan, still references the
        // initial object and did not change where it references.
        System.out.println("After invoking passMethod, ivan.name = " +
ivan.name);
    }

    // change parameter in passMethod()
    public static void passMethod(Person p) {
        p.name = "Milen";
        p = new Person();
    }
}
```

Car, Person Example

8. Create method in class Car

```
boolean isMoreExpensive(Car car)
```

9. Test it in class Demo

Car, Person Example

10. Create method in class Car

```
double calculateCarPriceForScrap(double
 metalPrice)
```

The price = metalPrice * coef

The coefficient starts from 0.2 and depends of the car's color and if it's sport:

- If the color is black or white, 0.05 is added to the coefficient
- If the car is sport, 0.05 is added to the coefficient

11. Test it in class Demo

Car, Person Example

To the class Person add fields:

11. money – money of the Person

12. car – reference to his own car

Car, Person Example

To the class Person add method:

13. `void buyCar(Car car)`

the person buy the car if has enough money

To the class Car add method:

14. `void changeOwner(Person newOwner)`

Car, Person Example

To the class Person add method:

15. `double sellCarForScrap(double metalPrice)`

    the method returns the money of the person after the car is sold for scrap

Summary

- Objects and referent types
- What is a reference
- Constructors
- Default constructor and how to use constructors
- How to call constructor in constructor
- Methods with returned types not void
- How to use *return* keyword