In this lecture, we introduce the main themes of the course. We start by reviewing the concept of

architecture neutral, then briefly describe the Java class as unit of programming, summarize the

main ​ features​ ​ of​ ​ Java,​ ​ and​ ​ conclude​ ​ with​ ​ a​ ​ few​ ​ ​examples,​ to​ ​ give​ ​ a​ ​ taste​ ​ of​ ​ Java.​

# 1.1 Design​ ​goals​ ​of​ ​Java​ ​programming​ ​language

The Java programming language was designed to fulfill the requirements of application development for a variety of network devices and embedded systems, in the context of heterogeneous distributed environments. The language is i​mperative and o​ bject-oriented with syntax similar to C++, but simple and elegant, removing all the unnecessary complexities of C++. The Java platform ​ architecture​ ​ is​ ​ neutral​ ​ and​ ​ portable.​

For example, to accommodate the diversity of devices and operating environments, the Java compiler ​ generates​ ​ an​ ​architecture​ ​neutral​intermediate ​ format​ ​ called​ ​bytecodes​*.*

Example ​ of​ ​ java​ ​ bytecodes:​

cafe​ ​babe​ ​0000​ ​0034​ ​001d​ ​0a00​ ​0600​ ​0f09 0010​ ​0011​ ​0800​ ​120a​ ​0013​ ​0014​ ​0700​ ​1507 0016​ ​0100​ ​063c​ ​696e​ ​6974​ ​3e01​ ​0003​ ​2829

Java is also a s​ tatically typed language, which means that every variable and expression has a type that is known at compile time. Java​ is a language that has only two data types: p​ rimitives and references​. Furthermore, primitive​ data always have the same size, regardless of the underlying running platform. For instance, the b​ yte data type is always an 8​ -bit signed two's complement integer.

# 1.2 Classes​ ​and​ ​objects

In Java, a class​​is the fundamental unit of programming. It defines the

template based on which objects can be built. Classes are discussed in detail in the next chapter. We assume the reader is familiar with object-oriented paradigm and understands basic concepts, such as ​ class​ ​ and​ ​ object.​

For ​ example,​ ​ in​ ​ Java,​ ​ a​ ​ class​ ​ could​ ​ be​ ​ defined​ ​ using​ ​ the​ ​ Java​ ​ keyword​ ​**class** ​ followed ​ by​ ​ a​

user ​ defined​ ​ name​ ​ (​ e.g. ​**Empty**)​ ​ and​ ​ open​ ​ and​​ closed​ ​ curly​​ brackets.​​ If​ ​ one​ ​ types​ ​ in​ ​ an​ ​ ​editor​ the​ following ​ text​ ​ and​ ​ saves​ ​ it​ ​ in​ ​ a​ ​ file​ ​ called​ ​**Empty.java**​, ​ ​one ​ has​ ​ the​​ simplest​ ​ Java​ ​ program​ ​ (\*).​ **class**​​**Empty**​​**{**

**}**

To ​ compile​ ​ the​ ​ Java​ ​ code,​ ​ one​ ​​needs ​ ​the ​**javac** ​ compiler.​ ​ Using​ ​ a​ ​ ​shell​ ​of ​ ​the ​ operating​ ​ ​system,​ ​if​ one​ types

**javac**​​**Empty.java**

a ​ new​ ​ file​ ​ is​ ​ generated.​ ​ The​​ file​​ will​ ​ have​ ​ the​​ name:​​ **Empty.class**​This ​ is​​ the​ ​ bytecodes​ ​ ​file ​ created​ by ​ the​ ​ Java​ ​ compiler.​

Empty.class ​ file:​

cafe​ ​babe​ ​0000​ ​0034​ ​000d​ ​0a00​ ​0300​ ​0a07 000b​ ​0700​ ​0c01​ ​0006​ ​3c69​ ​6e69​ ​743e​ ​0100

0328​ ​2956​ ​0100​ ​0443​ ​6f64​ ​6501​ ​000f​ ​4c69

6e65​ ​4e75​ ​6d62​ ​6572​ ​5461​ ​626c​ ​6501​ ​000a

536f​ ​7572​ ​6365​ ​4669​ ​6c65​ ​0100​ ​0a45​ ​6d70

7479​ ​2e6a​ ​6176​ ​610c​ ​0004​ ​0005​ ​0100​ ​0545

6d70​ ​7479​ ​0100​ ​106a​ ​6176​ ​612f​ ​6c61​ ​6e67

2f4f​ ​626a​ ​6563​ ​7400​ ​2000​ ​0200​ ​0300​ ​0000

0000​ ​0100​ ​0000​ ​0400​ ​0500​ ​0100​ ​0600​ ​0000

1d00​ ​0100​ ​0100​ ​0000​ ​052a​ ​b700​ ​01b1​ ​0000 0001​ ​0007​ ​0000​ ​0006​ ​0001​ ​0000​ ​0001​ ​0001 0008​ ​0000​ ​0002​ ​0009

To ​ run​ ​ a​ ​ Java​ ​ program​ ​ one​ ​ needs​ ​ a​ ​ Java​​ Virtual​ ​ Machine​ ​ (​ JVM) ​ called​ ​**java**.​​The ​ JVM​ ​ comes​

from ​ the​ ​ Java​ ​ Development​ ​ Kit​ ​ (​ JDK) ​ and​ ​ needs​ ​ to​ ​ be​ ​ installed​ ​ ​on​ ​the ​ ​machine ​ one​ ​ ​is​ ​using​ to​ develop ​ and​ ​ run​ ​ Java​ ​ programs.​ ​ More​ ​ on​ ​ the​ ​ installation​​ of​ ​ the​ ​ Java​ ​ platform​ ​ in​​ the​ ​ next​​ chapter.​ To ​ execute​ ​ the​ ​ above​ ​ Java​ ​ program​ ​ ​(\*), ​ within​ ​ the​ ​ operating​ ​ system​ ​ shell,​ ​ one​​ should​ ​ type​ ​ ​the following ​ command:​

**java**​​**Empty**

Since ​ the​ ​Empty ​ class​ ​ is​ ​ incomplete,​ ​ the​ ​ execution​ ​ ​will ​ generate​ ​ ​the ​ following​ ​ error:​

*Error:*​​*Main*​​*method*​​*not*​​*found*​​*in*​​*class*​​*Empty,*​​*please*​​*define*​​*the*​***main***​​*method*​​*as:*

*public*​​*static*​​*void*​***main***​*(String[]*​​*args)* ​(\*\*)The ​ error​ ​ is​ ​ self​ ​ explanatory:​ ​ we​ ​ are​ ​ missing​ ​ the​ ​ implementation​ ​ of​ ​ the​ ​**main** ​ ​method, ​ which​ ​ is​ ​ the​ entry ​ point​ ​ for​ ​ the​ ​ execution​ ​ of​​ any​ ​ Java​ ​ ​program.

# 1.3 Java​ ​platform​ ​features

To ​ take​ ​ full​ ​ advantage​ ​ of​ ​ the​​ power​ ​ of​ ​ the​​ ​Java ​ platform​ ​ when​​ building​ ​ applications,​​ three​

programming ​ paradigms​ ​ are​ ​ discussed​ ​ in​ ​ this​ ​ book:​ ​ objective-oriented,​ ​ functional,​​ and​ ​ ​reactive programming.

In ​ the​ ​ first​ ​ part​ ​ of​ ​ this​ ​ course,​ ​ ​we ​ will​ ​ study​ ​ the​ ​ *language*​​*basics.*​We ​ will​ ​ ​introduce ​ the​

basic ​ data​ ​ types,​ ​ starting​ ​ with​ ​ the​ ​ built-in​ ​ types;​ ​ then​​ we​ ​ will​ ​ discuss​ ​ user​ ​ defined​​ type​ ​ by​​ studying:​

* Classes ​ and​ ​ Interfaces​ ​ (​ nested ​ and​ ​ inner​​ classes)​ ​ in​ ​Java​
* Inheritance ​ and​ ​ Polymorphism​
* Annotations
* Packages
* Generics
* Exception
* Threads
* Basic ​ Java​ ​ I/O​

In ​ the​ ​ second​ ​ part​ ​ of​ ​ this​ ​ course,​ ​ we​ ​ will​ ​ study​ ​ fundamental​ ​ *design*​​*patterns*​ ​ in​ ​ Java,​ ​ such​ ​ as​ creational, ​ structural​ ​ and​ ​ behaviour​ ​ design​ ​ patterns:​

* Singleton ​ and​ ​ Factory​
* Adapter ​ and​ ​ Composite​
* Observer ​ and​ ​ Visitor​

Java ​ as​ ​ a​ ​ *functional*​​*programming*​ ​ language​ ​ ​will ​ be​​ examined​ ​ ​in ​ ​the ​ third​ ​ part​​ of​ ​ the​ ​ book​ ​ by​ studying ​ the​ ​ Java​ ​ Collection​ ​ through:​

* Functional ​ Interfaces​
* Lambda ​ Expressions​
* Streams

To ​ build​ ​ Java​ ​ applications,​ ​ we​ ​ need​ ​ to​ ​ use​ ​ specific​ ​ ​Java​ frameworks.​ ​ As​ ​ an​ ​ example,​ ​ in​ ​ the​

fourth ​ part​ ​ of​ ​ this​ ​ book,​ ​ we​ ​ will​ ​ examine​ ​ the​ ​ *reactive*​​*programming*​ ​ paradigm​ ​ ​in ​ Java​ ​ by​​ studying​ *RxJava*​ ​ as​ ​ a​ ​ framework​ ​ for​ ​ writing​ ​ asynchronous,​ ​ concurrent,​ ​ and​​ resilient​ ​ ​applications.

# 1.4 A​ ​taste​ ​of​ ​Java

Before ​ we​ ​ dive​ ​ into​ ​ all​ ​ these​ ​ concepts,​ ​ to​ ​ have​ ​ ​a​ better​ ​ understanding​ ​ of​ ​ where​ ​ we​ ​ are​

going, ​ we​ ​ shall​ ​ illustrate​ ​ some​ ​ features​ ​ ​of ​ ​the ​ language​ ​ ​through ​ small​ ​ examples.​

By ​ tradition,​ ​ the​ ​ first​ ​ program​ ​ ​for ​ any​​ new​ ​ programming​ ​ language​ ​ must​ ​ print​ ​ ​“Hello

World!”. ​ Here​ ​ is​ ​ the​ ​​Java​ version​ ​ of​ ​ such​ ​ a​ ​ ​program:

Hello​ ​World​ ​program

A ​ program​ ​ that​ ​ prints​ ​ “Hello​ ​ World”​​ is,​ ​ by​ ​ tradition,​​ ​the ​ first​ ​ program​​ that​ ​ one​​ develops​ when ​ learning​ ​ a​ ​ new​ ​ programming​ ​ ​language. ​ Here​​ is​ ​ our​ ​ “Hello​ ​ World”​ ​ ​program ​ in​ ​ ​Java:

|  |
| --- |
| */\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\** ​​*\**​​*Compilation:*​​*javac*​​*First.java*  ​​*\**​​*Execution:*​​*java*​​*First*  ​​*\**  ​​*\**​​*Prints*​​*"Hello*​​*World!"*​​*to*​​*the*​​*terminal* ​​*\**  ​​*\**​​*>*​​*java*​​*First* ​​*\**​​*Hello*​​*World!*  ​​*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/*    public​ class​ ​First​ ​{    ​ public​ static​ void​ main(​ ​String []​ ​ *args*​) ​ {​  ​ System.​out​.​println(​"Hello​ ​World!"​); ​ ​}  } |

Our program defines a class called ​**First** and​ implements the ​**main** method. The method is the entry point for the program execution. Therefore, the signature of the method cannot be changed. The keywords ​**static** and ​**public** are interchangeable, but they are mandatory. The only parameter of the **main**​ method is an array of strings whose elements are used as the command-line arguments for our program. Starting with Java version 5.0, one could pass an unspecified number of arguments to a method. Java treats the variable-length argument list as an array. Therefore, it is also ​ correct​ ​ to​ ​ define​ ​ the​ ​**main** ​ method​ ​ as​ :​

**public**​ **static**​ **void**​ **main**​**(**​**String**​​**...**​ ***args***​**)**

A class could have many overloaded ​**main** methods. However, if there is no ​**main** method

with ​ the​ ​ signature​ ​ described​ ​ above,​ ​ the​ ​ interpreter​ ​ will​ ​ issue​ ​ ​an​ error​ ​ at​ ​ runtime​ ​ (​ see ​ \*\*).​

Filter​ ​string​ ​program

Now, let us consider an example of lambda expression in Java. There is a in **java.util**​ package a public interface called ​**Predicate<T>**.​ The interface represents a predicate (a boolean-valued function) of one argument. The functional​ interface has a functional method called **test(Object)**.​

We ​ will​ ​ use​ ​ this​ ​ interface​ ​ to​ ​ ​filter ​ ​a ​ collection​ ​ ​of ​ type​​ list​​ ​of ​​strings. ​ ​The ​ ​list​ ​is​ ​composed​ ​of programming ​ language​ ​ names.​ ​ We​ ​ want​ ​ to​​ print​ ​ all​ ​ the​​ ​languages ​ whose​ ​ name​​ length​ ​ is​​ greater​ than ​ a​ ​ given​ ​ value.​

The ​ important​ ​ method​ ​ of​ ​ class​ ​**Filter** ​ ​is ​ called​​ **filter**.​​ It​​ takes​ ​ two​ ​ arguments:​ ​ the​ ​ *list*​ ​ that​

needs ​ to​ ​ be​ ​ filtered​ ​ and​ ​ the​ ​ *predicate*​ ​ ​based ​ on​ ​ ​which ​ the​​ ​filter ​ is​ ​ executed.​ ​ ​The ​ method​ ​ returns​ ​ the​ filtered ​ list.​

​​**public**​ **static**​ **<T>**​ **List<T>**​ **filter**​**(List<T>**​ ​ ***data***​**,**​ **Predicate<T>**​ ***predicate***​**)**

The ​ main​ ​ method​ ​ creates​ ​ the​ ​ list​ ​ of​ ​ strings​ ​ and​​ invokes​ ​ the​ ​ filter​ ​ method.​ ​ The​​ actual​ ​ arguments​​ are​ the ​**languages** ​ as​ ​ a​ ​ list​ ​ of​ ​ ​strings ​ and​​ the​ ​**predicate** ​ object​ ​ implemented​ ​ as​ ​ a​ ​ lambda​​ expression:​

**filter(languages,**​​**s**​ **->**​​**s**​**.**​**length()**​ **>**​ **3**​**)**

Finally, ​ the​ ​**main** ​ method​ ​ prints​ ​ the​ ​ result​ ​ (​ i.e., ​ the​ ​ filtered​ ​ ​list).

|  |
| --- |
| */\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\** ​​*\**​​*Compilation:*​​*javac*​​*Filter.java*  ​​*\**​​*Execution:*​​*java*​​*Filter* ​​*\**  ​​*\**​​*Filter*​​*a*​​*list*​​*of*​​*strings*  ​​*\**​​*The*​​*filter*​​*is*​​*a*​​*predicate*​​*defined*​​*by*​​*the*​​*condition*​​*string*​​*length*​​*>*​​*3*  ​​*\**  ​​*\**​​*For*​​*the*​​*list:*​​*"C++",*​​*"Java",*​​*"Python"*​​*the*​​*result*​​*of*​​*executing*  ​​*\**  ​​*\**​​*>*​​*java*​​*Filter* ​​*\**​​*[Java*​​*Python]*  ​​*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/*  import​ java.util.ArrayList​; import ​ java.util.Arrays;​ import​ java.util.List​;  import​ java.util.function.Predicate​;    public​ class​ ​Filter​ ​{    ​ */\*\**  ​​*\**​​*Filter*​​*a*​​*data*​​*structure*​​*of*​​*type*​​*list* |
| ​​*\**  ​​*\**​ *@param*​​*data*​​*The*​​*list*​​*that*​​*needs*​​*to*​​*be*​​*filtered*  ​​*\**​ *@param*​​*predicate*​​*Functional*​​*interface*  ​​*\**​​*whose*​​*functional*​​*method*​​*is*​​*test(Object)*  ​​*\**​ *@return*​​*The*​​*filtered*​​*list*  ​​*\*/*  ​ public​ static​ <T>​ List<T>​ filter​(​List<T>​ *data*​,​ Predicate<T>​ *predicate*​)​ ​{  ​ List<T>​ ​list​ =​ new​ ArrayList<>​(​0​);    ​ for​ ​(​T​ ​t​ : ​ data)​  ​ if ​ (​ predicate.​ test(t))​  ​ ​list​.​add(t);    ​ return ​ list;​  ​ ​}    ​ public ​ static ​ void ​ main(​ String​ ​[] ​ *args*​) ​ {​    ​ *//*​​*defines*​​*the*​​*list*​​*of*​​*strings*  ​ List<String> ​ languages​ ​ = ​ Arrays.asList(​ "C++"​ ,​ ​ "Java",​ ​ "Python")​ ;  ​ *//*​​*filter*​​*the*​​*list*​​*of*​​*strings*​​*on*​​*the*​​*predicate*​​*length*​​*>*​​*3* ​ List<String>​ ​result​ =​ ​filter(languages,​ ​s​ ->​ ​s​.​length()​ >​ 3​);  ​ *//*​​*prints*​​*the*​​*filtered*​​*list*  ​ System.​out​.​println(result);  ​ ​}  } |

The ​ advantage​ ​ of​ ​​using ​ lambda​ ​ expressions​ ​ ​is ​ major.​​ It​ ​ ​allows ​ ​us ​ to​ ​ pass​​ not​ ​ only​ ​ values,​ ​ but​

also ​ behaviors​ ​ (​ e.g., ​ the​ ​ predicate).​ ​ This​ ​ enables​ ​ us​ ​ ​to​ dramatically​ ​ raise​ ​ the​ ​ abstraction​ ​ level.​

Filter ​ stream​ ​ program​

As a last example, to illustrate the evolution of Java programming language, we will use Streams API. By defining ​Streams as ​Monads,​ Java becomes a language, where the functional paradigm becomes a reality. What the functional programming did to Java is it closed the gap between a program’s “domain intent” (the problem we want to solve) and the computation performed ​ to​ ​ carry​ ​ out​ ​ the​ ​ intent.​

For instance, as an extension to the previous example, we would like to process a list of programming language names, so that we can print with capital letters, sorted alphabetically, all the ​ programming​ ​ language​ ​ names​ ​ that​ ​ contain​​ the​ ​ letter​ ​ ​“a.”

|  |
| --- |
| */\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**  ​​*\**​​*Compilation:*​​*javac*​​*StreamFilter.java*  ​​*\**​​*Execution:*​​*java*​​*StreamFilter*  ​​*\**  ​​*\**​​*Filter*​​*a*​​*list*​​*of*​​*strings,*​​*change*​​*selected*​​*string*​​*to*​​*uppercase,*  ​​*\**​​*sort*​​*and*​​*print*​​*the*​​*string*  ​​*\**  ​​*\**​​*For*​​*the*​​*list:*​​*"C++",*​​*"Java",*​​*"Python",*​​*"Haskell"*​​*the*​​*result*​​*of*​​*executing*  ​​*\**  ​​*\**​​*>*​​*java*​​*StreamFilter*  ​​*\**​​*HASKELL*  ​​*\**​​*JAVA*  ​​*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/*  import​ java.util.Arrays​; import​ java.util.List​;    public​ class​ ​StreamFilter​ ​{    ​ public​ static​ void​ main​(​String​[]​ *args*​)​ ​{    ​ List<String>​ ​ls​ =​ Arrays.​asList(​"C++"​,​ "Java"​,​ "Python"​,​ "Haskell"​);  ​ ​ls​.​stream()​ *//*​​*convert*​​*list*​​*to*​​*stream*  ​ ​.filter(s​ -> ​ s​ .​ contains(​"a"​​))​ *//*​​*filter*​​*strings*  ​ ​.map(​String::​toUpperCase) ​ *//*​​*change*​​*them*​​*to*​​*uppercase*  ​ ​.sorted()​ *//*​​*sort*​​*them*​​*alphabetically*  ​ .forEach(​ ​System.​out​::println);​ ​ *//*​​*print*​​*the*​​*selected*​​*language* ​ ​} } |

# 1.5 Chapter ​ resources​

Java API documentation is the most important resource for Java developers. It is freely available ​ from:​ ​ http://docs.oracle.com/javase/8/docs/api/

More about the Java Platform, Standard Edition version 8, (the version available at the time of writing), ​ can​ ​ be​ ​ found​ ​ at​ ​http://docs.oracle.com/javase/8/

# 1.6 Exercises

1.​ ​ Write​ ​ a​ ​ program​ ​ that​ ​ prints​ ​ the​ ​ command-line​ ​ ​arguments.

For example, if your program is ​Exercise\_1, then when you run the program ​java

Exercise\_1​ ​Alice​ ​Bill,​ your ​ program​​ must​ ​ print​ ​Alice​ ​Bill.

1. ​ Write​ ​ a​ ​ program​ ​ ​that ​ ​prints ​ the​ ​ command-line​ ​ arguments​ ​ in​ ​ reverse​ ​ order.​

For example, if your program is ​Exercise\_2, then when you run the program java​

Exercise\_2​ ​Alice​ ​Bill,​ your ​ program​​ must​ ​ print​ ​Bill​ ​Alice.

1. Develop a static method called ​start. The method takes as an argument an integer and prints the character ‘\*’ as many times as the integer value indicates. It returns nothing (i.e., void ​ type).​ ​ Write​ ​ a​ ​ program​ ​ that​ ​ prints​ ​ the​ ​ following​ ​ pattern:​

\*

\*\*

\*\*\*

\*\*\*\* \*\*\*\*\*

using ​ the​ ​start ​ method.​ ​ Write​ ​ java​ ​ documentation​​ for​ ​ the​ ​start​ method.​

4. ​ The​ ​ following​ ​ program​ ​ will​ ​ be​ ​ ​executed ​ as​​ java ​Exercise\_4​ 2​​ ​0​ ​1​ ​7

public​ class​ ​Exercise\_4​ ​{

​ public​ static​ void​ main​(​String​ ​...​ *args*​)​ ​{

​ for​ ​(​String​ ​s​:args)​

​ System.​out​.​print(s​ +​ "​ ​"​);

​ ​}

}

What ​ does​ ​ it​ ​ print?​

1. Compilation ​ error​
2. It ​ prints​ ​ nothing​
3. It ​ prints​ ​ 2​ ​ 0​ ​ 1​ ​ 7​

# 1.6 A​ ​challenging​ ​exercise

5. Write a program that prints only the command-line arguments that have only four characters ​ and​ ​ all​ ​ four​ ​ are​ ​ digits.​

For example, if your program is ​Exercise\_5, then when you run the program ​java

Exercise\_5 ​ 23455​ ​ 1​ a34 ​ 34​ cd​ 9876​ , ​ your ​ ​program ​ must​ ​print​ ​​9876.

Hints:

Use ​ the​ ​ methods​ ​match ​ and​ ​length​ from​ ​ the​ ​ class​ ​String

*public*​​*boolean*​​*matches(*​*String*​​*regex)*

*Tells*​​*whether*​​*or*​​*not*​​*this*​​*string*​​*matches*​​*the*​​*given*​ *regular*​​*expression*​*.*

*public*​​*int*​​*length()*

*Returns*​​*the*​​*length*​​*of*​​*this*​​*string.*​​*The*​​*length*​​*is*​​*equal*​​*to*​​*the*​​*number*​​*of*​ *Unicode code*​​*units*​​*in*​​*the*​​*string.*

Example: ​string.matches("[0-9]+")