

# Trivial problem

Write a Java program that prints the Java's age.

```
import franck.cse1020.Today;

/**
 * This app prints the age of Java.
 *
 * @author Franck van Breugel
 */
public class AgeOfJava
{
    public static void main(String [] arguments)
    {
        ...
    }
}
```

## Body of main Method

```
import franck.cse.Today;
...
int birthYear = 1995;
int currentYear = Today.getYear();
int birthDay = 143;
int currentDay = Today.getDay();
int daysPerYear = 365;
int year = currentYear - birthYear;
double fraction = (double) (currentDay - birthDay)
                  / (double) daysPerYear;
System.out.print("The age of Java is: ");
System.out.println((double) year + fraction);
```

## Question

What is **casting**?

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## Answer

A unary operator that convert a value of one type to a corresponding value of another type.

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What is the type of the operator `(double) ·` in `(double) year + fraction`?

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## Answer

`(double) · : int → double`

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Can the cast in `(double) year + fraction` be left out? Explain why or why not.

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## Answer

Yes. In that case, `fraction` is of type `double` and `year` is of type `int`, and, hence, the compiler can add the cast `(double)` automatically.



## Question

Can one of the casts in  $(\text{double}) (\text{currentDay} - \text{birthDay}) / (\text{double}) \text{daysPerYear}$  be left out? Explain why or why not.

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## Answer

Yes. In that case, one of the expressions is of type double and the other is of type int, and, hence, the compiler can add the cast  $(\text{double})$  automatically.

## Question

Can both casts in

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`(double) (currentDay - birthDay) / (double) daysPerYear` be left out? Explain why or why not.

## Answer

No. In that case, both expressions are of type `int`, and, hence, the division operator `/` of type `int × int → int` is used, which does not give the desired result.

# The Price of Gold



source: [www.goldeneaglecoin.com](http://www.goldeneaglecoin.com)

# The Price of Gold

Write an app that pops up a dialog box with the title “The Price of Gold” and the message “Enter the amount of gold in kilos” and, after the user has entered the amount  $k$  and clicks the OK button, pops up another dialog box with the title “The Price of  $k$  kilos of Gold” and the current price of  $k$  kilos of Gold in Canadian dollars. If the user enters a negative amount, the app crashes with the message “The amount of gold cannot be negative.”

# Determine the Price of $k$ Kilos of Gold in Canadian Dollars

Forget about writing an app for now. How would *you* solve this problem for  $k = 0.5$ ?

- Using Google, find a website that contains the current gold price.

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- Using Google, find a website that contains the current exchange rate.

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- But the price is given in US dollars (Pound sterling and the euro), not in Canadian dollars. How do we address this?
- Using Google, find a website that contains the current exchange rate.
- <http://www.gocurrency.com>

# Delegation

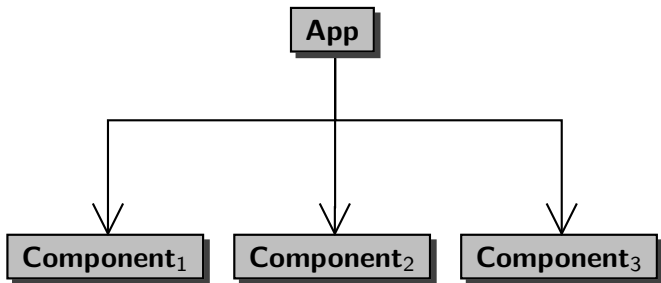
In our solution we use [delegation](#). Instead of solving a particular part of the puzzle ourselves, we ask someone else to do it for us.

For example, we delegate to `www.goldprice.org` for the current price of gold.

Could we do it ourselves?

Yes, we could travel to London where the price of gold is determined daily at 10.30 am and 3.00 pm, but delegation seems a little easier.

Also when writing an app, we try to delegate.





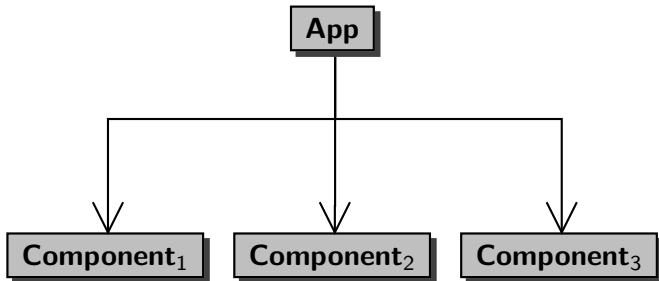
# Bugs can be Expensive

Flight 501, which took place on June 4, 1996, was the first, and unsuccessful, test flight of the European Ariane 5 expendable launch system. Due to an [integer overflow](#), the rocket veered off its flight path 37 seconds after launch and was destroyed by its automated self-destruct system. It is one of the most infamous computer bugs in history costing roughly \$ 370,000,000.



source: [www.airliners.net](http://www.airliners.net)

# Who is to Blame for the Bug?



- The user of the app (**user**)?
- The developer of the app (**client**)?
- The developer of one of the components (**implementer**)?

# Interface of a Component

An interface is a **contract** between the client of the component and the implementer of the component.

For each operation, it specifies

- **parameters**: “the type of data to be provided by the client to the component”
- **precondition**: “a property to be satisfied by the data provided by the client to the component”
- **postcondition**: “a property to be satisfied by the data returned by the component to the client”

The **precondition** is the **client**'s responsibility and the **postcondition** is the **implementer**'s responsibility.

## parameters

amount : integer

## precondition

amount  $< 10^{23}$

## postcondition

returns the amount converted from euros to US dollars

## Question

Assume that the client provides -1 to the component and the component crashes. Who is to blame?

## parameters

amount : integer

## precondition

amount  $< 10^{23}$

## postcondition

returns the amount converted from euros to US dollars

## Question

Assume that the client provides -1 to the component and the component crashes. Who is to blame?

## Answer

The implementer, since the client has done its job by providing an integer that satisfies the precondition, whereas the implementer did not satisfy the postcondition.

## parameters

amount : integer

## precondition

amount  $< 10^{23}$

## postcondition

returns the amount converted from euros to US dollars

## Question

Assume that the client provides  $10^{23}$  to the component and the component crashes. Who is to blame?

## parameters

amount : integer

## precondition

amount  $< 10^{23}$

## postcondition

returns the amount converted from euros to US dollars

## Question

Assume that the client provides  $10^{23}$  to the component and the component crashes. Who is to blame?

## Answer

The client, since the client did not provide an integer that satisfies the precondition.

# Advantages of Interfaces

- **Accountability**: if something goes wrong, then the interface can be used to determine who is to blame.
- **Abstraction**: the interface abstracts from many implementations details (an interface of a component is usually much simpler than the code of the component).  
The interface specifies **what** the component does, **not how** it does it.
- **Substitutibility**: the implementer can change the code of the component as long as it still conforms to the interface, without affecting the client in any way.



# Let's Go Component Shopping!

The interface of a Java class is described by its [Application Programming Interface \(API\)](#). Many of these APIs can be found on the Internet.

- Java Standard Library (JSL)  
`download.oracle.com/javase/6/docs/api`
- TYPE package  
`www.cse.yorku.ca/java/api/type/api`

## Convention

If the precondition is “true” (that is, it holds vacuously) then it is left out.

All classes in the JSL contain no preconditions.

## Convention

If the postcondition is “returns what is specified by **Returns:**” and “crashes as specified by **Throws:**” then it is left out.

All classes in the JSL contain no postconditions.

```
public static type methodName(type1 parameterName1,  
..., typen parameterNamen)
```

- All methods we will use in our apps are **public**.
- All methods we will use this week are **static**. Next week, we will discuss methods that are not static.
- **type** is the type of the value that is returned by the method.
- **methodName** is the name of the method.
- **type<sub>i</sub>** is the type of the parameter named **parameterName<sub>i</sub>**.

```
public static double price()
```

## Question

What is the type of the value returned by the method `price`?

```
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## Question

What is the type of the value returned by the method `price`?

## Answer

`double`.

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## Answer

`double`.

## Question

How many parameters does the method `price` have?

```
public static double price()
```

## Question

What is the type of the value returned by the method `price`?

## Answer

`double`.

## Question

How many parameters does the method `price` have?

## Answer

Zero.

```
public static void methodName(type1 parameterName1,  
..., typen parameterNamen)
```

- All methods we will use in our apps are **public**.
- All methods we will use this week are **static**. Next week, we will discuss methods that are not static.
- **The method does not return anything.**
- **methodName** is the name of the method.
- **type<sub>i</sub>** is the type of the parameter named **parameterName<sub>i</sub>**.



# Invoking a Static Method

Consider the method `public static type methodName(type1 parameterName1, ..., typen parameterNamen)` in the class `ClassName`.

This method is invoked as

`ClassName.methodName(argument1, ..., argumentn)`

where the type of `argumenti` is (compatible with) `typei`.