Strings

Strings and their methods

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Topics list - **Strings**

1. Primitive Types: **char**
2. Object Types: **String**
3. **Primitive** Types **versus Object** Types
4. Strings and **Java API**
5. Strings - **methods**
6. **Method calls**
   - **Internal**
   - **External**
   - **Dot notation**
7. Using String methods: some **examples**

Recap: Primitive Types

- Java programming language supports eight primitive data types.

- The char data type stores one single character which is delimited by single quotes(‘)
  e.g.

  char letter = ‘a’;

Data Type	Default Value
byte	0
short	0
int	0
long	0L
float	0.0f
double	0.0d
char	'\u0000'
boolean	false

Primitive Types: **char**

```
// VALID USE
char letter  = ‘n’;        //Assign ‘n’ to the letter variable
char letter = ‘N’;         //Assign ‘N’ to the letter variable

// INVALID USE
char letter = n;           //ERROR – no single quotes around n.
char letter = “n”;         //ERROR – double quotes around n.
char letter = “not”;       //ERROR – char can only hold one character.
```

Source: Reas & Fry (2014)

Primitive Types: char

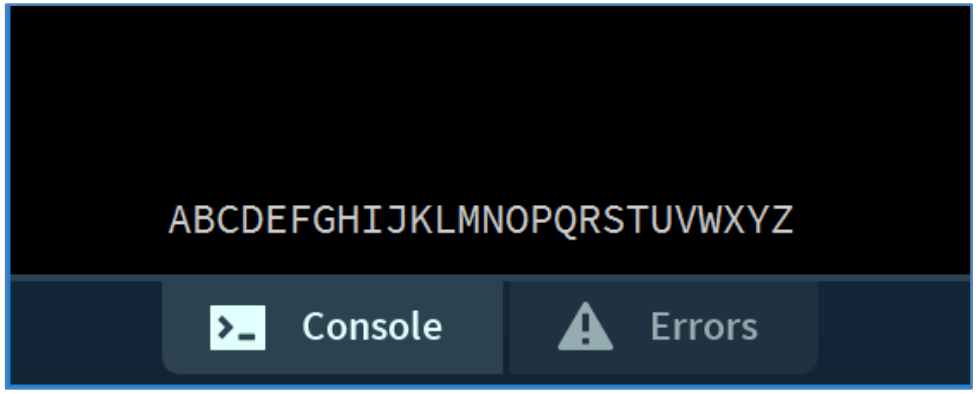
- char is a 16-bit Unicode character.
- It’s values range:
  - from '\u0000‘ (or 0)
  - to '\uffff' (or 65,535)
- For example:
  - ‘A’ is ‘\u0041’
  - ‘a’ is ‘\u0061’

http://en.wikipedia.org/wiki/List_of_Unicode_characters

Example 3.18 – Alphabet

Example_3_18

```
1 char letter = 'A';
2
3 for (int i = 0; i < 26; i++)
4 {
5   print(letter);
6   letter++;
7 }
```



This code uses the underlying **Unicode** value for 'A' (i.e. '\u0041')
and adds one to it each time the for loop is iterated.

As the for loop is iterated 26 times,
and the starting value is 'A',
our loop will print the alphabet to the console.

Source: Reas & Fry (2014)

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Object types e.g. String

- Strings, which are widely used in Java programming, are a sequence of characters enclosed by double quotes (“”).
  e.g. **“seq of chars”**

- In Java, a **String** is an **object type**.
- The Java platform provides the **String class** to create and manipulate strings.
- The most direct way to create a **String** is to write:

  String greeting = "Hello world!";

http://www.tutorialspoint.com/java/pdf/java_strings.pdf

Object types - **String**

```
// VALID USE
String str = “I am a sentence”;  //Assigns the full sentence to str variable.
String word = “dog”;      //Assigns the word “dog” to the word variable.
String letter = “A”;      //Assigns the letter “A” to the letter variable.

// INVALID USE
String letter = n;        //ERROR – no double quotes around n.
String letter = ‘n’;      //ERROR – single quotes around n; use double.
string letter = “n”;      //ERROR – String should have a capital S.
```

Object Data Types start with a Capital Letter to distinguish them from Primitive data types

Source: Reas & Fry (2014)

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Primitive types vs. **Object** types

Primitive type

```
int i = 17;
```

Primitive types vs. Object types

Primitive type

```
int i = 17;
```

Directly stored in memory…

17

Primitive types vs. Object types

Primitive type

```
int i = 17;
```

Directly stored in memory…

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Object type

```
String hi = "Hello";
```

Primitive types vs. Object types

Primitive type

```
int i = 17;
```

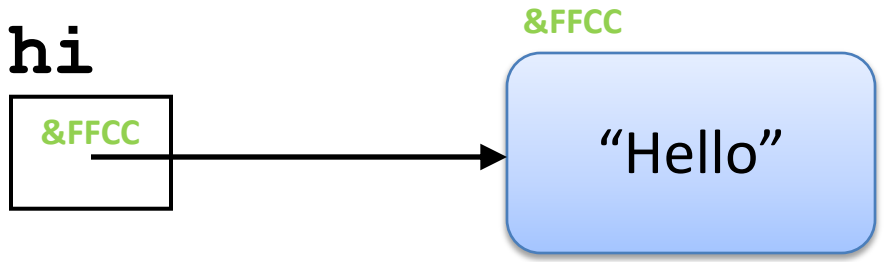
Directly stored in memory…

17

Object type

```
String hi = "Hello";
```

hi variable contains a reference (*address*) to where the String is stored in memory



Primitive types vs. Object types

Primitive type

```
int i = 17;
```

Directly stored
in memory…

17

With **primitive type** variables
(e.g. int, float, char, etc)

the **value** of the variable
is stored
in the memory location
assigned to the variable.

Primitive types vs. **Object** types

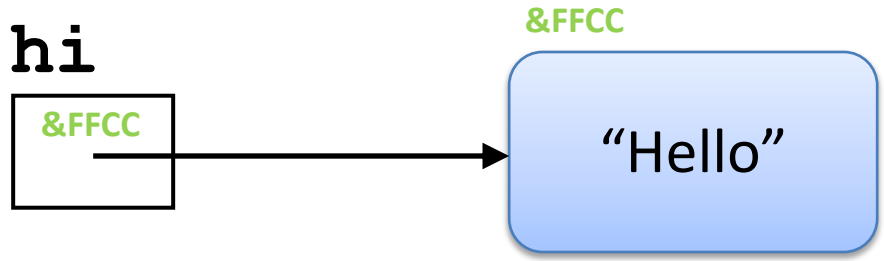
With object types,
the variable holds the **memory address**
of where the object is located
– not the values inside the object.

This memory address is called
a **reference** to the object.

Object type

```
String hi = "Hello";
```

hi variable
contains a reference (*address*)
to where the String is stored in memory



Primitive types vs. Object types

Now that we know how primitive types and object types store data,

we will look at this statement (b=a) in the context of primitive and object types.

```
b = a;
```

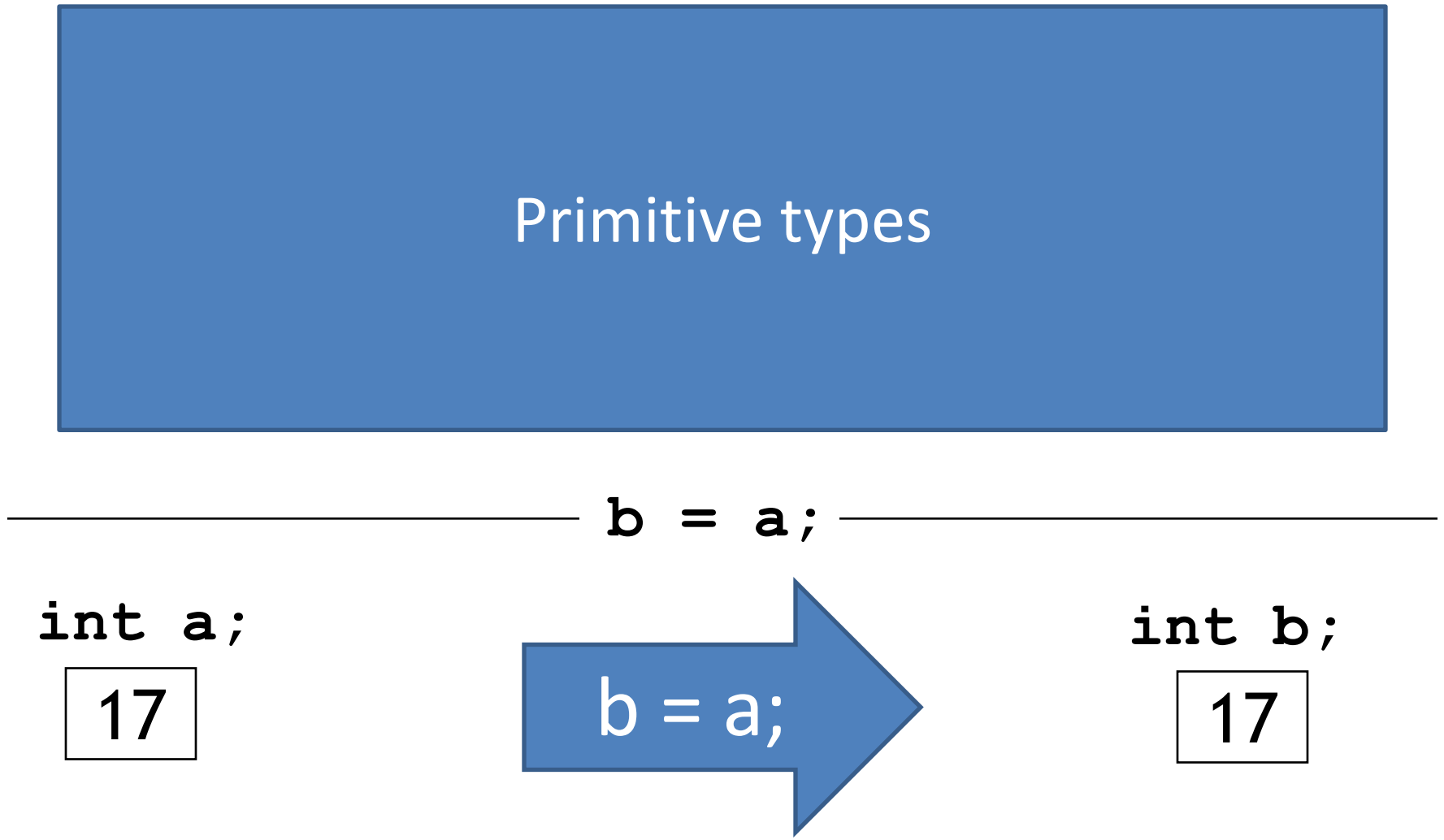
Primitive types vs. Object types


```
b = a;
```

```
int a;
```

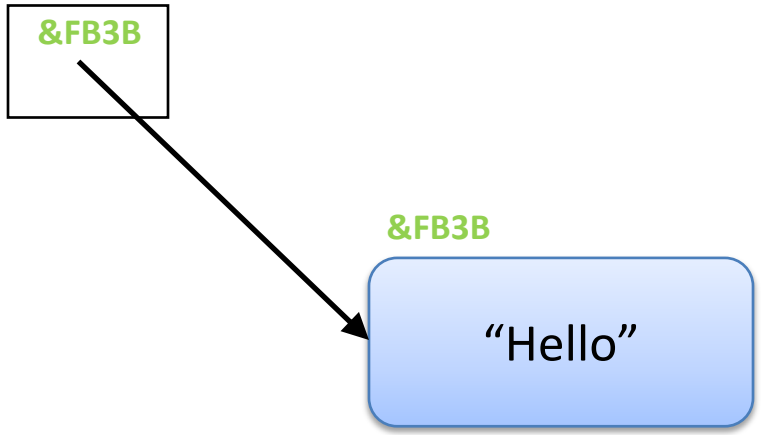
17

Primitive types vs. Object types



Primitive types vs. **Object** types

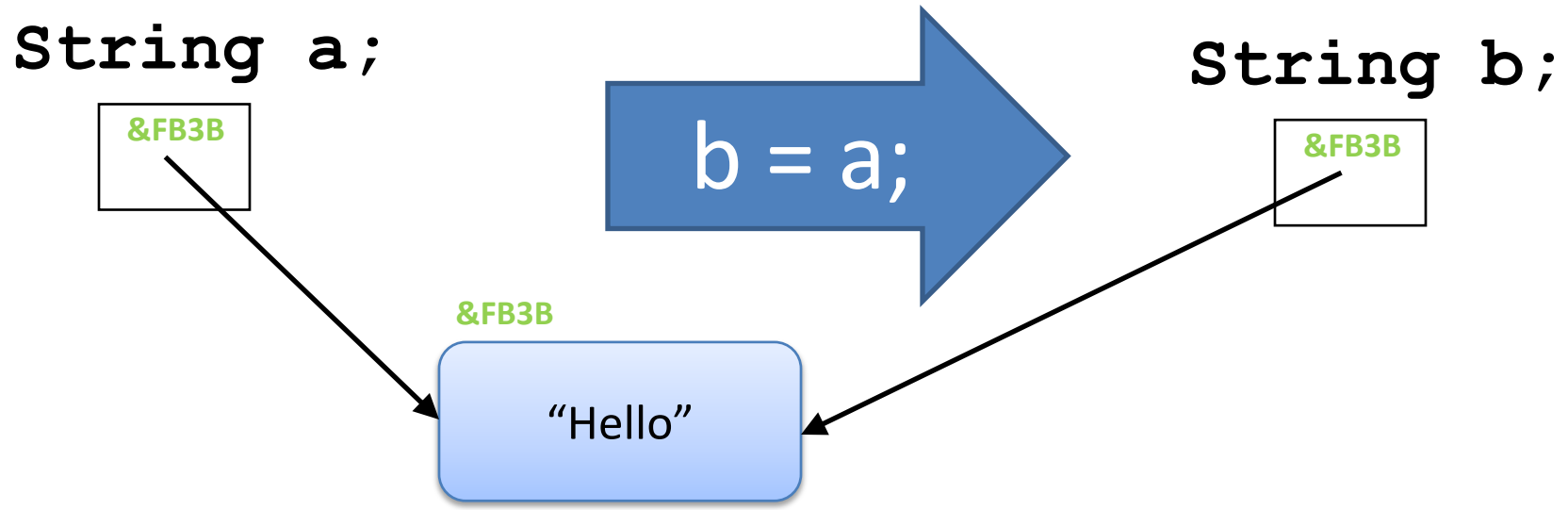
```
String a;
```




```
b = a;
```

Object types

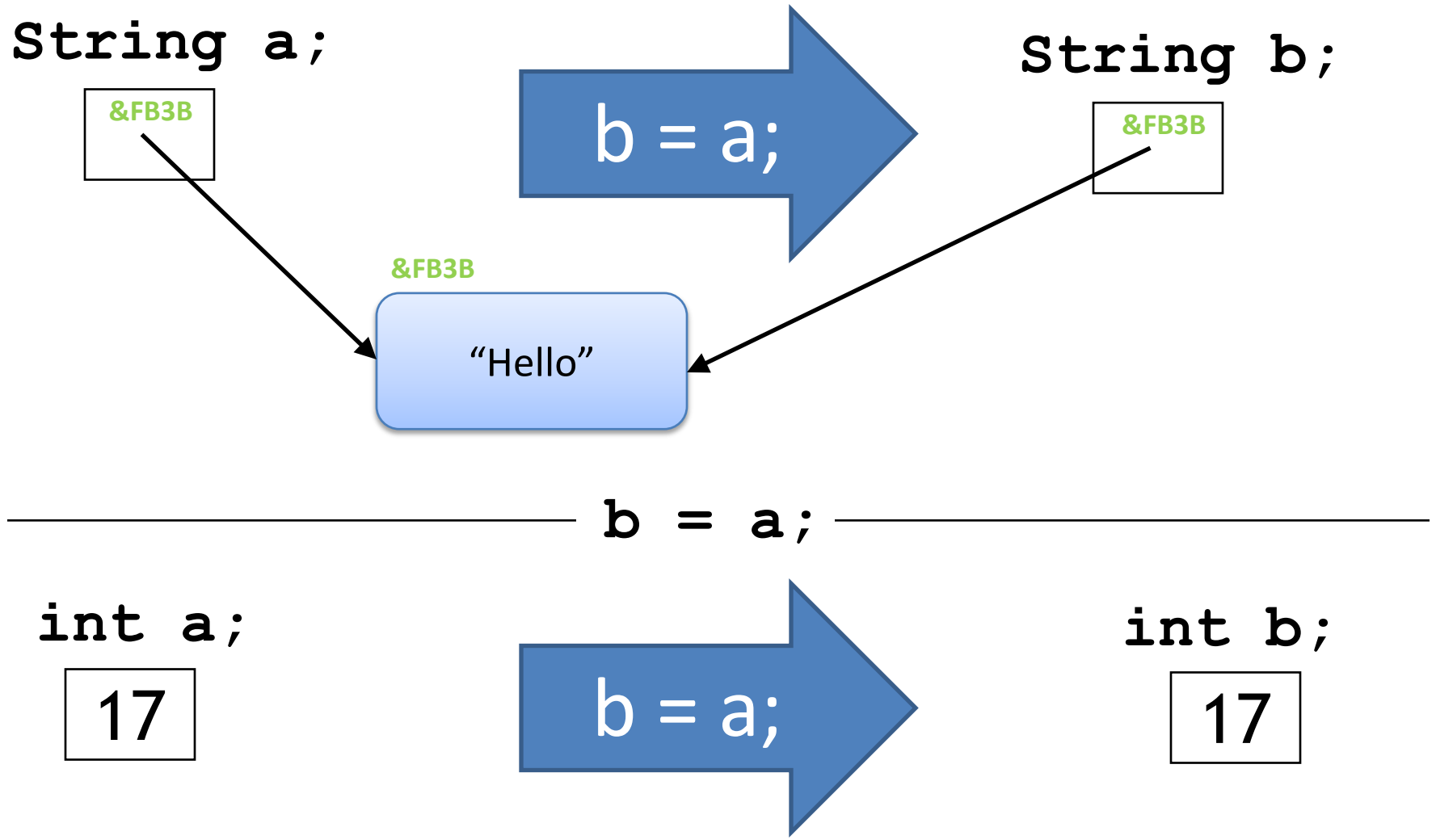
Primitive types vs. **Object** types



`b = a;`

Object types

Primitive types **vs**. Object types



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Strings are objects

- Variables created with the **String** data type are called **objects**.

- Objects are **software structures** that combine
  - **variables**
  - with **methods** that operate on those variables
    e.g.
    - every String object has a built-in method that can capitalise its letters.

Strings and **Java's API**

- This link is to Java's **A**pplication **P**rogramming **I**nterface (**API**), version 8.

  https://docs.oracle.com/javase/8/docs/api/index.html?overview-summary.html

- More information on the **String**'s **methods**:

  https://docs.oracle.com/javase/8/docs/api/java/lang/String.html

- Explore newer versions

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Strings - some API methods

Return Type	**Method** Name	Description
int	**length**()	Returns the length of this string.
String	**toLowerCase**()	Converts all of the characters in this String to lower case.
String	**toUpperCase**()	Converts all of the characters in this String to upper case.
String	**trim**()	Returns a string whose value is this string, with any *leading and trailing* whitespace removed.
String	**substring**(int beginIndex, int endIndex)	Returns a string that is a substring of this string.
char	**charAt**(int index)	Returns the char value at the specified index.

https://docs.oracle.com/javase/8/docs/api/java/lang/String.html

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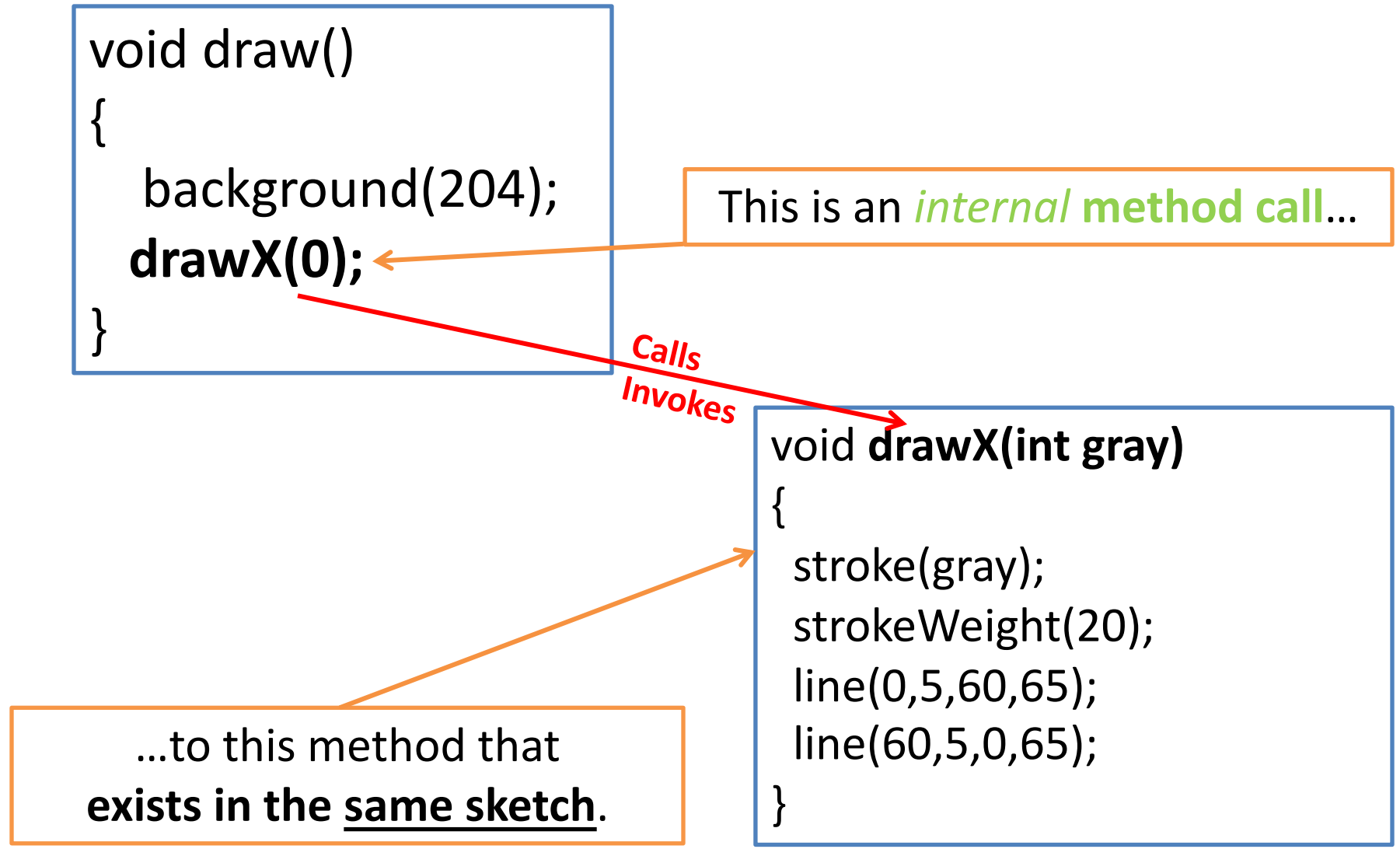
Strings and methods

- To use these built-in methods, we must first understand the difference between:
  - **Internal** method calls

    and
  -

    External method calls

Internal method calls



Internal method calls

- **drawX(0)** is a method call.
- The sketch has a method with the following *signature/header*:

  void drawX(int gray)

- The method call *invokes* this method.

- As the method is **in the same sketch** as the call of the method, we call it an ***internal*** method call.

- Internal method calls have the syntax:

  methodname (parameter-list)

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External method calls

- We want to check the length of this String:

  String name = “Joe Soap”;

- Looking at the **String API**, we can see this method:

Return Type	Method	Description
int	**length**()	Returns the length of this string.

- A **call to a method of another object** is called an ***external*** method call.

  (objects {e.g.String} are usually defined in their own separate files)

External method calls

- External method calls have the syntax:

object.methodname (parameter-list)

- To find out the length of this String:

```
String name = “Joe Soap”;
```

- We make the following external method call:

```
name.length();
```

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Dot Notation

- Java code can call methods of other objects using dot notation.

- The syntax is:

  object.methodname (parameter-list)

- It consists of:
  - An object
  - A dot
  - A method name
  - The parameter(s) for the method

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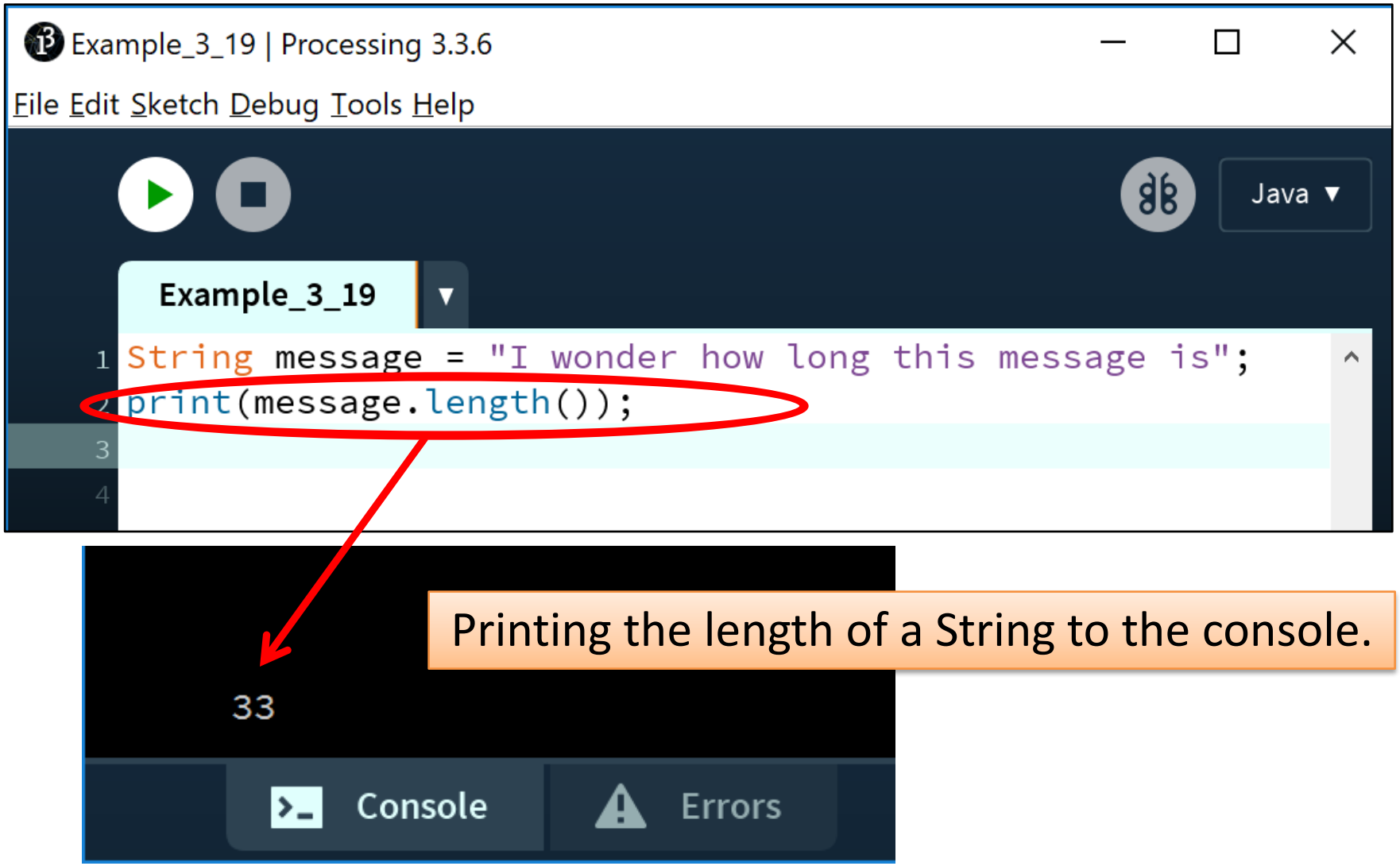
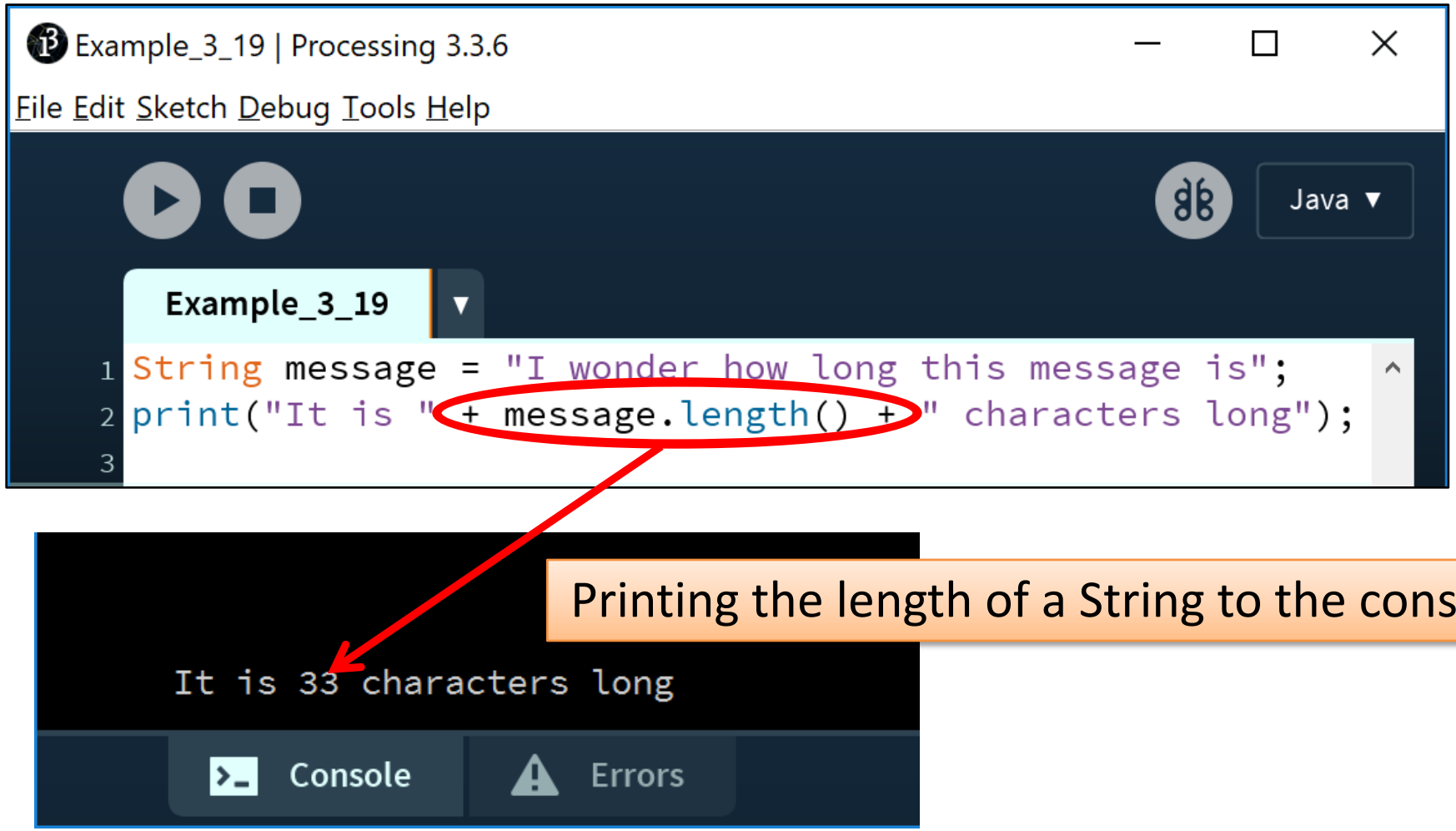
Example 3.19, Version 1

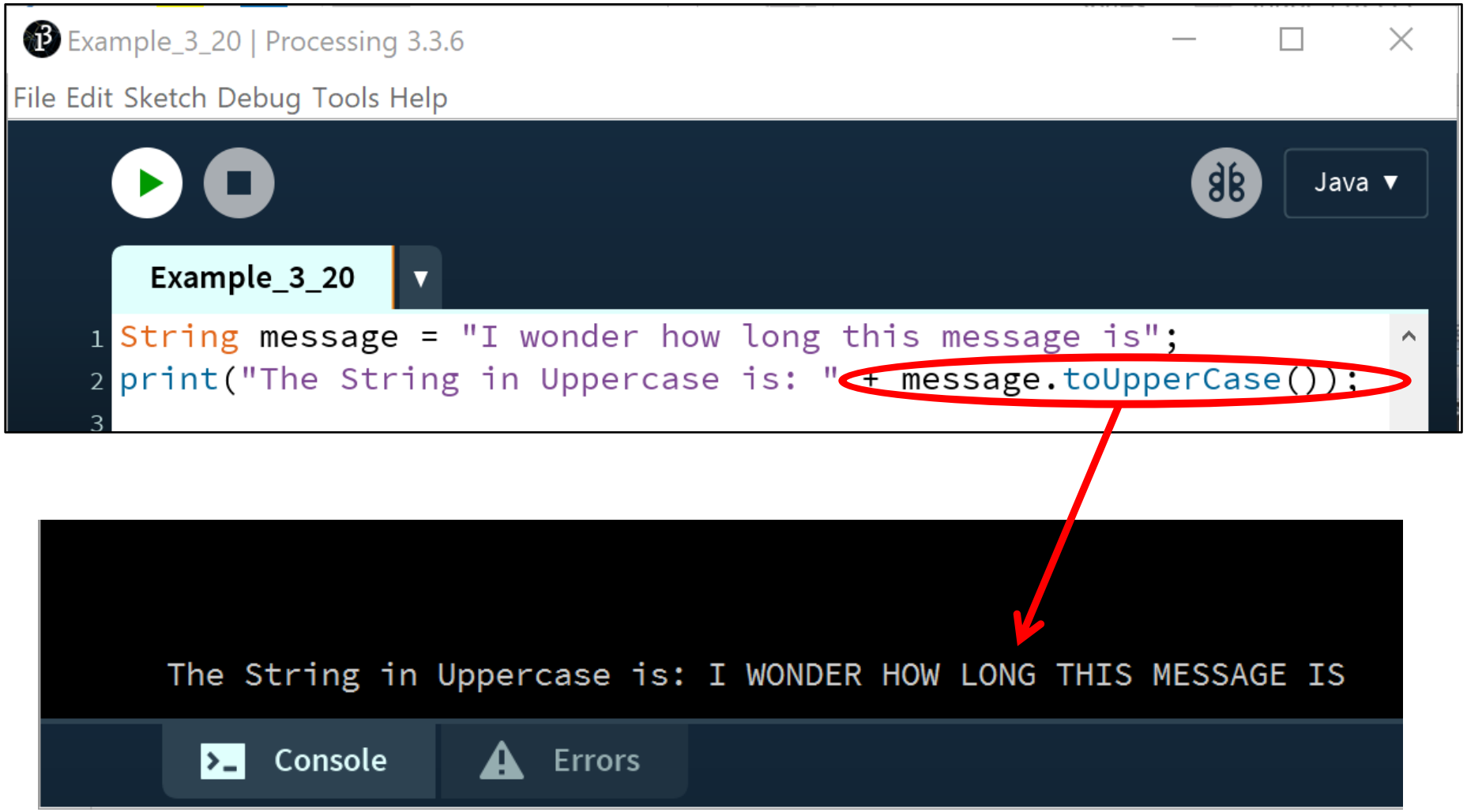


Example 3.19, Version 2



Example 3.20

Converting a String to UPPERCASE and printing it to the console.

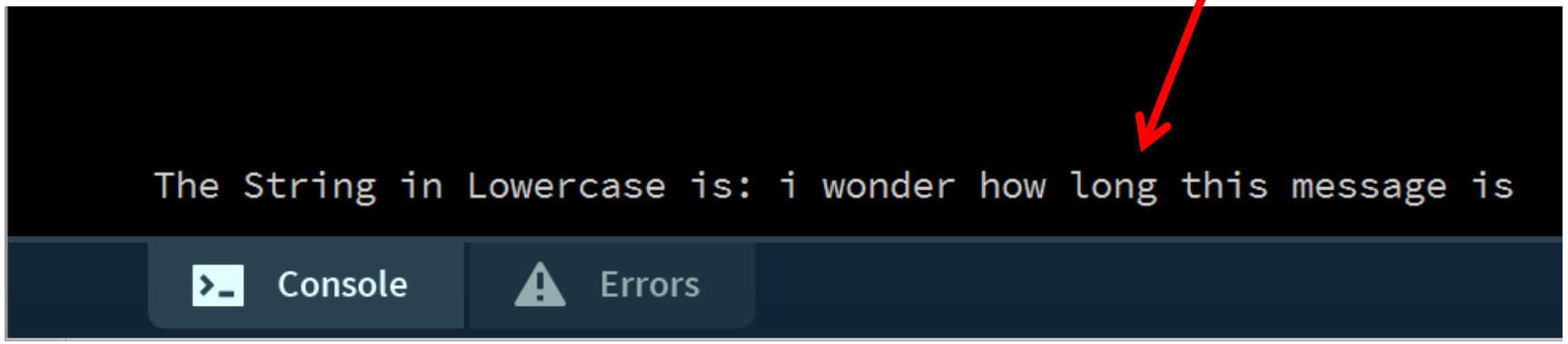


Example 3.21

Converting a String to lowercase and printing it to the console.

Example_3_21

```
1 String message = "I wonder how long this message is";
2 print("The String in Lowercase is: " + message.toLowerCase());
```



Example 3.22

Removing all the leading and trailing spaces in a String and printing it to the console.

Example_3_22

```
3
4  String trimmedMessage = message.trim();
5  int trimmedLengthOfMsg = trimmedMessage.length();
6
7  println("The original message " + message
8      + " is " + originalLengthOfMsg + " characters long");
9
10 println("The trimmed message " + trimmedMessage
11     + " is " + trimmedLengthOfMsg + " characters long");
```

```
The original message    HTTP 404 Not Found Error    is 33 characters long
The trimmed message HTTP 404 Not Found Error is 24 characters long
```

Console Errors

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Questions?

References

- Reas, C. & Fry, B. (2014) Processing – A Programming Handbook for Visual Designers and Artists, 2nd Edition, MIT Press, London.