The String Class

String class facts

- An object of the String class represents a string of characters.
- The String class belongs to the java.lang package, which does not require an import statement.
- Like other classes, String has constructors and methods.
- Unlike other classes, String has two operators, + and += (used for concatenation).

Literal Strings

- are anonymous objects of the String class
- are defined by enclosing text in double quotes. “This is a literal String”
- don’t have to be constructed.
- can be assigned to String variables.
- can be passed to methods and constructors as parameters.
- have methods you can call.

Literal String examples

```
//assign a literal to a String variable
String name = “Robert”;

//calling a method on a literal String
char firstInitial = “Robert”.charAt(0);

//calling a method on a String variable
char firstInitial = name.charAt(0);
```

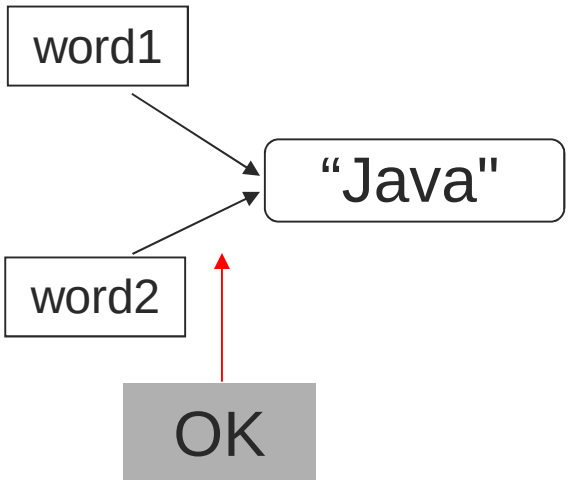
Immutability

- Once created, a string cannot be changed: none of its methods changes the string.
- Such objects are called *immutable*.
- Immutable objects are convenient because several references can point to the same object safely: there is no danger of changing an object through one reference without the others being aware of the change.

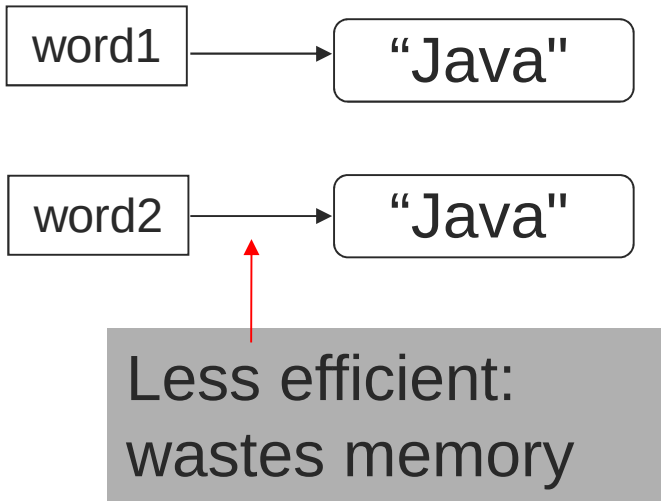
Advantages Of Immutability

Uses less memory.

```
String word1 = "Java";
String word2 = "Java";
```



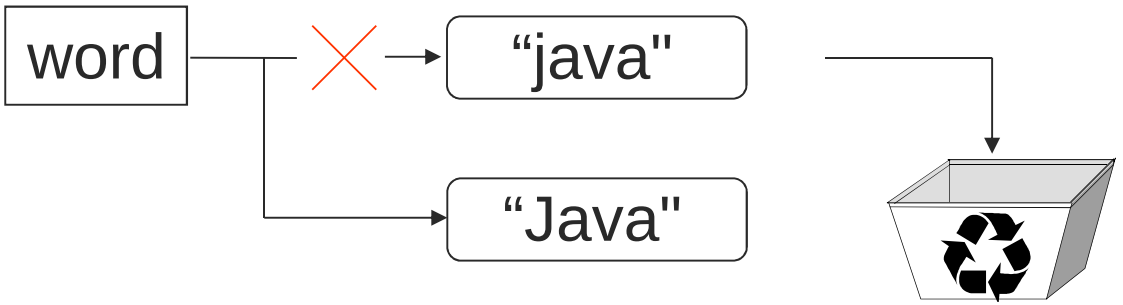

```
String word1 = “Java";
String word2 = new String("Java");
```



Disadvantages of Immutability

Less efficient — you need to create a new string and throw away the old one even for small changes.

```
String word = “Java";
char ch = Character.toUpperCase(word.charAt (0));
word =  ch + word.substring (1);
```



Empty Strings

- An empty String has no characters. It's length is 0.

```
String word1 = "";
String word2 = new String();
```

Empty strings

- Not the same as an uninitialized String.

```
private String errorMsg;
```

errorMsg is **null**

No Argument Constructors

- No-argument constructor creates an empty String. Rarely used.

```
String empty = new String();
```

- A more common approach is to reassign the variable to an empty literal String. (Often done to reinitialize a variable used to store input.)

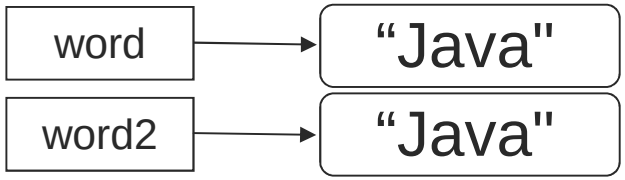
```
String empty = “”;//nothing between quotes
```

Copy Constructors

- Copy constructor creates a copy of an existing String. Also rarely used.
- Not the same as an assignment.

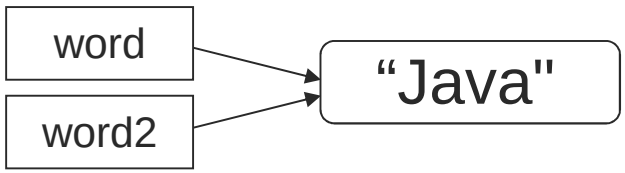
Copy Constructor: Each variable points to a different copy of the String.

```
String word = new String("Java");
String word2 = new String(word);
```



Assignment: Both variables point to the same String.

```
String word = "Java";
String word2 = word;
```



Other Constructors

Most other constructors take an array as a parameter to create a String.

```
char[] letters = {‘J’, ‘a’, ‘v’, ‘a’};
String word = new String(letters);//”Java”
```

Methods — length, charAt

int length();

- Returns the number of characters in the string

char charAt(i);

- Returns the char at position i.

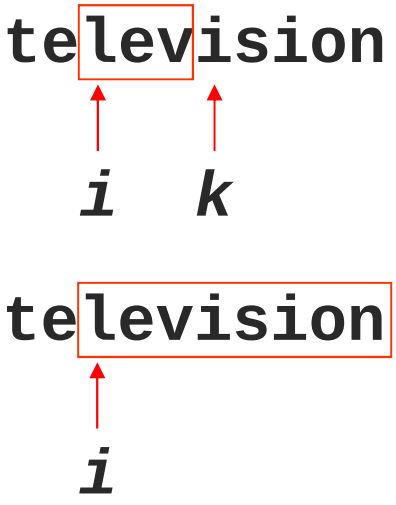
Character positions in strings are numbered starting from 0 – just like arrays.

	Returns:
”Problem".length();	7
”Window".charAt (2);	’n'

Methods — substring

Returns a new String by copying characters from an existing String.

- String subs = word.**substring** (i, k);
  - returns the substring of chars in positions from **i** to **k-1**
- String subs = word.**substring** (i);
  - returns the substring from the **i**-th char to the end




```
"television".substring (2,5);
"immutable".substring (2);
"bob".substring (9);
```

Returns:

- "lev"
- "mutable"
- "" (empty string)

Methods — Concatenation

String word1 = “re”, word2 = “think”; word3 = “ing”;
int num = 2;

- String result = word1 **+** word2;
  //concatenates word1 and word2 “rethink“
- String result = word1.**concat** (word2);
  //the same as word1 + word2 “rethink“
- **result +=** word3;
  //concatenates word3 to result “rethinking”
- **result** += num; //converts num to String
  //and concatenates it to result “rethinking2”

Methods — Find (indexOf)

String name =“President George Washington";

	Returns:
name.indexOf (‘P');	0
name.indexOf (‘e');	2
name.indexOf (“George");	10
name.indexOf (‘e', 3);	(starts searching at position 3)
name.indexOf (“Bob");	-1 (not found)
name.lastIndexOf (‘e');	15

Methods — Equality

boolean b = word1.**equals**(word2);

returns **true** if the string **word1** is equal to **word2**

boolean b = word1.**equalsIgnoreCase**(word2);

returns **true** if the string **word1** matches **word2**, case-blind

```
b = “Raiders”.equals(“Raiders”);//true
b = “Raiders”.equals(“raiders”);//false
b = “Raiders”.equalsIgnoreCase(“raiders”);//true
```

```
if(team.equalsIgnoreCase(“raiders”))
      System.out.println(“Go You “ + team);
```

Methods — Comparisons

int diff = word1.**compareTo**(word2);
returns the “difference” **word1 - word2**

int diff = word1.**compareToIgnoreCase**(word2);
returns the “difference” **word1 - word2**,
case-blind

Usually programmers don’t care what the numerical “difference” of **word1 - word2** is, just whether the difference is negative (word1 comes before word2), zero (word1 and word2 are equal) or positive (word1 comes after word2). Often used in conditional statements.

```
if(word1.compareTo(word2) > 0){
        //word1 comes after word2…
}
```

Methods — trim

String word2 = **word1.trim** ();

returns a new string formed from **word1** by
removing white space at both ends
does not affect whites space in the middle

```
String word1 = “ Hi Bob “;
String word2 = word1.trim();
//word2 is “Hi Bob” – no spaces on either end
//word1 is still “ Hi Bob “ – with spaces
```

Methods — replace

String word2 = word1.**replace**(oldCh, newCh);

returns a new string formed from **word1** by replacing all occurrences of **oldCh** with **newCh**

```
String word1 = “rare“;
String word2 = “rare“.replace(‘r’, ‘d’);
//word2 is “dade”, but word1 is still “rare“
```

Methods — Changing Case

String word2 = word1.**toUpperCase**();
String word3 = word1.**toLowerCase**();

returns a new string formed from **word1** by converting its characters to upper (lower) case

```
String word1 = “HeLLo“;
String word2 = word1.toUpperCase();//”HELLO”
String word3 = word1.toLowerCase();//”hello”
//word1 is still “HeLLo“
```

Replacements

- Example: to “convert” word1 to upper case, replace the reference with a new reference.

```
word1 = word1.toUpperCase();
```

- A common bug:

```
word1.toUpperCase();
```

word1 remains unchanged

Numbers to Strings

Three ways to convert a number into a string:

1. String s = "" + num;

   s = “” + 123;//”123”

2. String s = Integer.toString (i);

   String s = Double.toString (d);

   s = Integer.toString(123);//”123”
   s = Double.toString(3.14); //”3.14”

3. String s = String.valueOf (num);

   s = String.valueOf(123);//”123”

Integer and **Double** are “wrapper” classes from **java.lang** that represent numbers as objects. They also provide useful static methods.