Java String

In java, string is basically an object that represents sequence of char values. An array of characters works same as java string. For example:

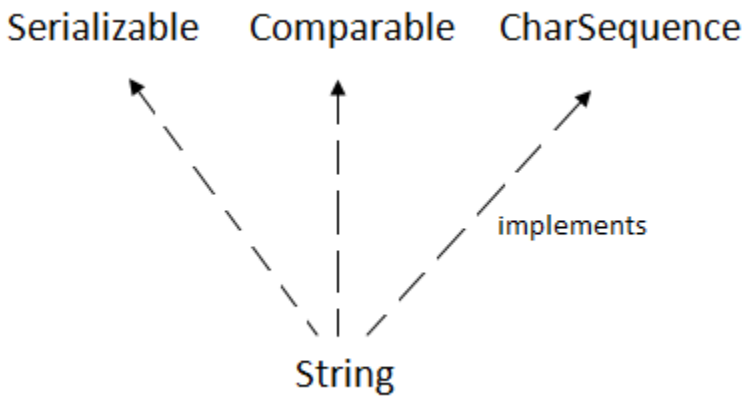
```
1. char[] ch={'s','a','u','r','a','b','h'};
2. String s=new String(ch);
```

is same as:

```
1. String s="saurabh";
```

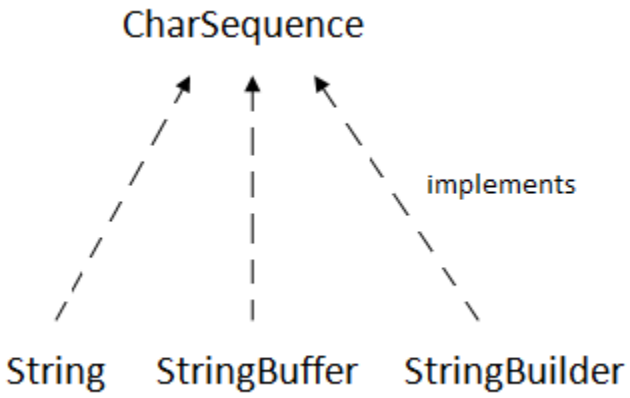
Java String class provides a lot of methods to perform operations on string such as compare(), concat(), equals(), split(), length(), replace(), compareTo(), intern(), substring() etc.

The java.lang.String class implements *Serializable*, *Comparable* and *CharSequence* interfaces.



CharSequence Interface

The CharSequence interface is used to represent sequence of characters. It is implemented by String, StringBuffer and StringBuilder classes. It means, we can create string in java by using these 3 classes.



The java String is immutable i.e. it cannot be changed. Whenever we change any string, a new instance is created. For mutable string, you can use StringBuffer and StringBuilder classes.

We will discuss about immutable string later. Let's first understand what is string in java and how to create the string object.

What is String in java

Generally, string is a sequence of characters. But in java, string is an object that represents a sequence of characters. The java.lang.String class is used to create string object.

How to create String object?

There are two ways to create String object:

1. By string literal
2. By new keyword

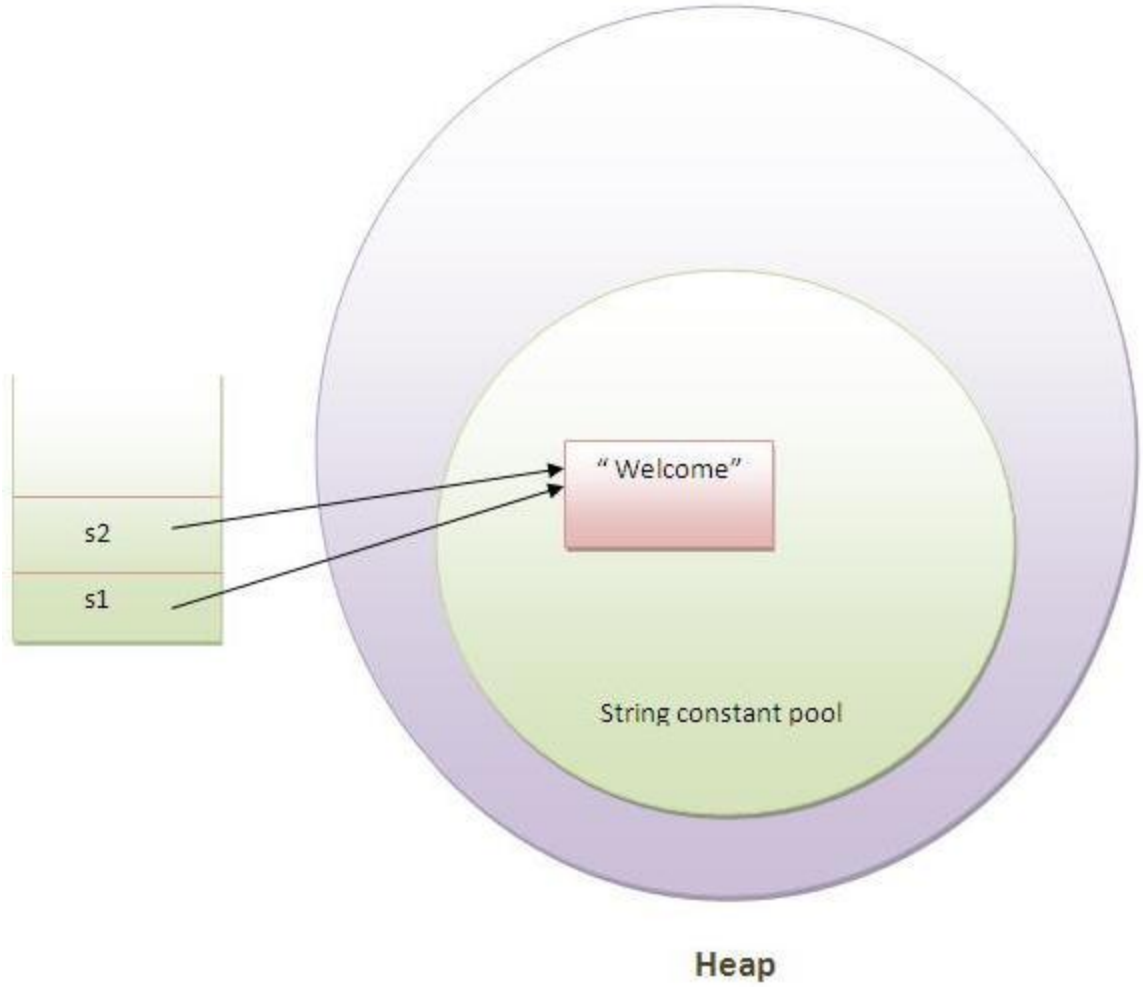
1) String Literal

Java String literal is created by using double quotes. For Example:

```
1. String s="welcome";
```

Each time you create a string literal, the JVM checks the string constant pool(SCP) first. If the string already exists in the pool, a reference to the pooled instance is returned. If string doesn't exist in the pool, a new string instance is created and placed in the pool. For example:

1. String s1="Welcome";
2. String s2="Welcome";//will not create new instance



In the above example only one object will be created. Firstly JVM will not find any string object with the value "Welcome" in string constant pool, so it will create a new object. After that it will find the string with the value "Welcome" in the pool, it will not create new object but will return the reference to the same instance.

Note: String objects are stored in a special memory area known as string constant pool.

Why java uses concept of string literal?

To make Java more memory efficient (because no new objects are created if it exists already in string constant pool).

2) By new keyword

1. String s=**new** String("Welcome");//creates two objects and one reference variable

   In such case, JVM will create a new string object in normal(non pool) heap memory and the literal "Welcome" will be placed in the string constant pool. The variable s will refer to the object in heap(non pool).

Java String Example

```
1. public class StringExample{
2. public static void main(String args[]){
3. String s1="java";//creating string by java string literal
4. char ch[]={'s','t','r','i','n','g','s'};
5. String s2=new String(ch);//converting char array to string
6. String s3=new String("example");//creating java string by new keyword
7. System.out.println(s1);
8. System.out.println(s2);
9. System.out.println(s3);
10. }}
```

Output:

```
java
strings
example
```

Java String class methods

The java.lang.String class provides many useful methods to perform operations on sequence of char values.

No.	Method	Description
1	char charAt(int index)	returns char value for the particular index
2	int length()	returns string length
3	static String format(String format, Object... args)	returns formatted string

4	static String format(Locale l, String format, Object... args)	returns formatted string with given locale
5	String substring(int beginIndex)	returns substring for given begin index
6	String substring(int beginIndex, int endIndex)	returns substring for given begin index and end index
7	boolean contains(CharSequence s)	returns true or false after matching the sequence of char value
8	static String join(CharSequence delimiter, CharSequence... elements)	returns a joined string
9	static String join(CharSequence delimiter, Iterable<? extends CharSequence> elements)	returns a joined string
10	boolean equals(Object another)	checks the equality of string with object
11	boolean isEmpty()	checks if string is empty
12	String concat(String str)	concatinates specified string
13	String replace(char old, char new)	replaces all occurrences of specified char value
14	String replace(CharSequence old, CharSequence new)	replaces all occurrences of specified CharSequence
15	static String equalsIgnoreCase(String another)	compares another string. It doesn't check case.
16	String[] split(String regex)	returns splitted string matching regex
17	String[] split(String regex, int limit)	returns splitted string matching regex and limit
18	String intern()	returns interned string
19	int indexOf(int ch)	returns specified char value index
20	int indexOf(int ch, int fromIndex)	returns specified char value index starting with given index

21	int indexOf(String substring)	returns specified substring index
22	int indexOf(String substring, int fromIndex)	returns specified substring index starting with given index
23	String toLowerCase()	returns string in lowercase.
24	String toLowerCase(Locale l)	returns string in lowercase using specified locale.
25	String toUpperCase()	returns string in uppercase.
26	String toUpperCase(Locale l)	returns string in uppercase using specified locale.
27	String trim()	removes beginning and ending spaces of this string.
28	static String valueOf(int value)	converts given type into string. It is overloaded.

Immutable String in Java

In java, **string objects are immutable**. Immutable simply means unmodifiable or unchangeable.

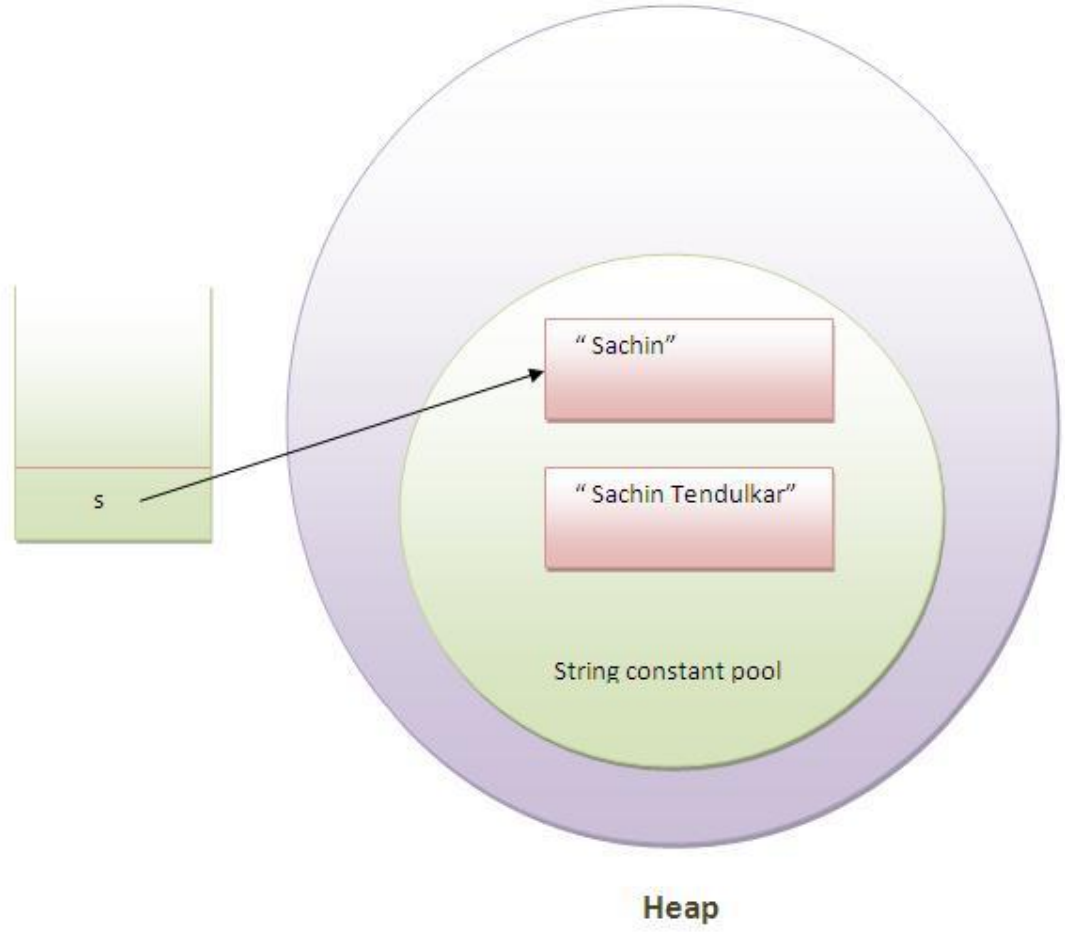
Once string object is created its data or state can't be changed but a new string object is created.

Let's try to understand the immutability concept by the example given below:

```
1. class Testimmutablestring{
2.  public static void main(String args[]){
3.    String s="Sachin";
4.    s.concat(" Tendulkar");//concat() method appends the string at the end
5.    System.out.println(s);//will print Sachin because strings are immutable objects
6.  }
7. }
```

Output:Sachin

Now it can be understood by the diagram given below. Here Sachin is not changed but a new object is created with sachintendulkar. That is why string is known as immutable.



As you can see in the above figure that two objects are created but s reference variable still refers to "Sachin" not to "Sachin Tendulkar".

But if we explicitely assign it to the reference variable, it will refer to "Sachin Tendulkar" object.For example:

```
1. class Testimmutablestring1{
2.  public static void main(String args[]){
3.    String s="Sachin";
4.    s=s.concat(" Tendulkar");
5.    System.out.println(s);
6.  }
7. }
```

Output:

Sachin Tendulkar

In such case, s points to the "Sachin Tendulkar". Please notice that still sachin object is not modified.

Why string objects are immutable in java?

Because java uses the concept of string literal. Suppose there are 5 reference variables, all refers to one object "sachin". If one reference variable changes the value of the object, it will be affected to all the reference variables. That is why string objects are immutable in java.

Java String compare

We can compare string in java on the basis of content and reference.

It is used in **authentication** (by equals() method), **sorting** (by compareTo() method), **reference matching** (by == operator) etc.

There are three ways to compare string in java:

1. By equals() method
2. By = = operator
3. By compareTo() method

1) String compare by equals() method

The String equals() method compares the original content of the string. It compares values of string for equality. String class provides two methods:

- **public boolean equals(Object another)** compares this string to the specified object.
- **public boolean equalsIgnoreCase(String another)** compares this String to another string, ignoring case.

```
1. class Teststringcomparison1{
2.  public static void main(String args[]){
3.    String s1="Sachin";
4.    String s2="Sachin";
5.    String s3=new String("Sachin");
6.    String s4="Saurav";
7.    System.out.println(s1.equals(s2));//true
```

```
8.     System.out.println(s1.equals(s3));//true
9.     System.out.println(s1.equals(s4));//false
10.  }
11. }
```

```
Output:
            true
            true
            false
```

```
1.  class Teststringcomparison2{
2.   public static void main(String args[]){
3.     String s1="Sachin";
4.     String s2="SACHIN";
5.
6.     System.out.println(s1.equals(s2));//false
7.     System.out.println(s1.equalsIgnoreCase(s3));//true
8.   }
9.  }
```

```
Output:false
       true
```

2) String compare by == operator

The = = operator compares references not values.

```
1.  class Teststringcomparison3{
2.   public static void main(String args[]){
3.     String s1="Sachin";
4.     String s2="Sachin";
5.     String s3=new String("Sachin");
6.     System.out.println(s1==s2);//true (because both refer to same instance)
7.     System.out.println(s1==s3);//false(because s3 refers to instance created in nonpool)
8.   }
9.  }
```

```
Output:
```

```
true
false
```

---

3) String compare by compareTo() method

The String compareTo() method compares values lexicographically and returns an integer value that describes if first string is less than, equal to or greater than second string.

Suppose s1 and s2 are two string variables. If:

- **s1 == s2** :0
- **s1 > s2** :positive value
- **s1 < s2** :negative value

```
1. class Teststringcomparison4{
2.  public static void main(String args[]){
3.    String s1="Sachin";
4.    String s2="Sachin";
5.    String s3="Ratan";
6.    System.out.println(s1.compareTo(s2));//0
7.    System.out.println(s1.compareTo(s3));//1(because s1>s3)
8.    System.out.println(s3.compareTo(s1));//-1(because s3 < s1 )
9.   }
10. }
```

Test it Now

```
Output:0
       1
       -1
```

String Concatenation in Java

In java, string concatenation forms a new string *that is* the combination of multiple strings. There are two ways to concat string in java:

1. By + (string concatenation) operator
2. By concat() method

1) String Concatenation by + (string concatenation) operator

Java string concatenation operator (+) is used to add strings. For Example:

```
1. class TestStringConcatenation1{
2.  public static void main(String args[]){
3.    String s="Sachin"+" Tendulkar";
4.    System.out.println(s);//Sachin Tendulkar
5.  }
6. }
```

Output:Sachin Tendulkar

The **Java compiler transforms** above code to this:

```
1. String s=(new StringBuilder()).append("Sachin").append(" Tendulkar).toString();
```

In java, String concatenation is implemented through the StringBuilder (or StringBuffer) class and its append method. String concatenation operator produces a new string by appending the second operand onto the end of the first operand. The string concatenation operator can concat not only string but primitive values also. For Example:

```
1. class TestStringConcatenation2{
2.  public static void main(String args[]){
3.    String s=50+30+"Sachin"+40+40;
4.    System.out.println(s);//80Sachin4040
5.  }
6. }
```

Output:

80Sachin4040

Note: After a string literal, all the + will be treated as string concatenation operator.

2) String Concatenation by concat() method

The String concat() method concatenates the specified string to the end of current string. Syntax:

```
1. public String concat(String another)
```

Let's see the example of String concat() method.

```
1. class TestStringConcatenation3{
2.  public static void main(String args[]){
3.    String s1="Sachin ";
4.    String s2="Tendulkar";
5.    String s3=s1.concat(s2);
6.    System.out.println(s3);//Sachin Tendulkar
7.   }
8. }
```

Output

```
Sachin Tendulkar
```