String Fundamentals

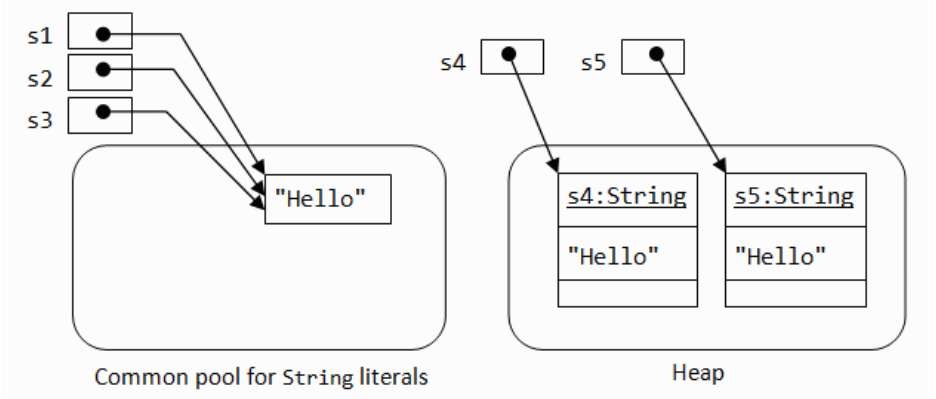
- String is a sequence of characters.
- Unlike other languages that implements strings as character arrays, Java implements strings as object of type String.
- String is immutable object, the contents of strings instance cannot be altered after it has been created.
- The String class is declared *final*, which means that can't be sub classed.

Constructing Strings

- Java maintains special memory called: String literal pool
- Is a pool of unique Strings: avoid duplicate
- **Using**
  - String literal
  - *new* keyword

1. String literal

- Strings are maintained in String literal Pool of a Heap. (String constant pool)
- ***String literal Pool*** is a pool of unique Strings, It avoids duplicate String objects in heap memory.
- **String str ="Hello";**
- Whenever compiler encounters a string literal, it creates a String object with given string value.
- JVM performs String pool check with following actions
  - *first checks String pool for the string literal.*
  - *if the literal is exist, return its reference.*
  - *If literal not exist, create the new literal in pool.*



2. **Using new keyword**
   - **String str = new String( );**
   - JVM doesn't perform String pool check if you create object using new operator.
   - Always creates new string object.

Example of Strings created

String s1 = "Hello" ; // String literal
String s2 = "Hello"; // String literal
String s3 = "Hello"; // String literal
String s4 = new String("Hello"); // String Object
String s5 = new String("Hello"); // String Object

The String Constructors

- Different forms of Constructors.

1. **String ( )**
   - **a.** Creates object with no characters
   - **b.** example: String str = new String( );
2. **String (char charArr[ ]) or**
3. **String (char charArr[ ], int startindex, int numchars)**
   - c. Creates string using char Array
   - d. Example:

```
char charArr[ ] = { 'a', 'b', 'c', 'd', 'e', 'f' };
String str = new String( charArr );
System.out.println( str );      // output: abc
String str = new String( charArr, 2, 3);
System.out.println( str );      // output: cde
```

4. **String (String strObj)**
   - e. Creates string using another string object
   - f. Example

```
String  s1 = new String ("abc");    //uses constructor
String  s2 = new String (s1);       //uses constructor
```

Three String-Related Language Features

- Java supports three especially useful string features within the syntax of the language.
- They are:
    a. **String literal**
    b. **String concatenation**
    c. **Overriding toString( )**

a. String literal

- A string literal is created by specifying a quoted string. For each string literal in your program, Java automatically constructs a String object.
    Example: String str = "MCA in RNSIT";

b. String concatenation:

- In java, string concatenation forms a new string that is the combination of multiple strings.
- There are two ways to concatenate string in java:
    1. Using operator: +(string concatention) operator
    2. Using method : concat( )

Example 1:

```
class TestStringConcatenation1 {
        public static void main(String args[ ]) {
            String s = "Sachin" + " Tendulkar";
            System.out.println(s);
        }
    }
```

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

Example 2:

```
class TestStringConcatenation3 {
    public static void main(String args[]) {
        String s1="Sachin ";
        String s2="Tendulkar";
        String s3=s1.concat(s2);
        System.out.println(s3);
    }
}
```

- The string concatenation operator can concat not only string but primitive values also.

Example 3:

```
class TestStringConcatenation2 {
    public static void main(String args[]) {
        int age=36;
        String str="he is " + age + "years old";
        System.out.println(str);
    }
```

c.Overriding toString( ):

- If you want to represent any object as a string, toString() method comes into existence.
- The toString() method returns the string that describes the object.
- By overriding the toString() method of the Object class, we can return values of the object, so we don't need to write much code.

```
Class Student
{
        int rollno;
        String name;

        Student(int rollno, String name){
                this.rollno=rollno;
                this.name =name;
        }
        public String toString( ) // overriding the toString() method
        {
                return rollno + " "+ name;
        }
        public static void main(String[] args){
                Student s =new Student(101,"Anil");
                System.out.println(s);
        }
}
```

Output:

101 Anil

The Length( ) Method

- The method length( ) returns the length of the string.
- A string's length is the number of characters that it contains.
- General form

  int length( )
- Example:

```
String str ="RNSIT"

System.out.println(str.length( ) ); // displays 5
```

Obtaining the characters within a string

- String class provides three ways in which character can be obtained from a string.
  a) charAt( )
  b) getChars( )
  c) toCharArray( )

a) charAt( )

- To obtain single character from a string.
- Syntax:

```
char charAt ( int index )
```

- *returns* a single character from a string at specified index.
- Example:

```
char ch;
  ch = "abzde".charAt( 2 ); //assigns the value "z" to ch.
```

b) getChars( )

- *Syntax:*

```
void getChars ( int sourceStart, int sourceEnd, char target[ ], int targetStart )
```

- *reads the set of characters from index **sourceStart** to the index **sourceEnd** and store in the **target** character array from a given index **targetStart**.*
- *Example:*

```
String str =”Programming is both art and science”;
char [ ] buf =new char[7]
str.getChars(2, 9, buf, 0);      // “ogrammi”
```

c) toCharArray( )

- Converts all characters in a string object into a character array.
- **Syntax**

```
char[ ] toCharArray()
```

- Returns an array of characters for the entire string
- **Example:**

```
char [ ]charArr = “RNS”.toCharArray()  // charArr = [‘R’,’N’,’S’]
for( char ch: charArr)
  System.out.println(charArr);
```

d) getBytes

- Syntax:

```
byte[]  getBytes()
```

- returns the array of bytes by encoding the source String.
- This method throws an exception **UnsupportedEncodingException,** and it should be surrounded with try-catch block.
- Example

```
byte []  b = "Aa".getBytes();  // b =  [ 65, 97 ]

for( byte x : b )
 System.out.println( x );      // prints  65 97
```

String comparison

- Different methods used for string comparison are
    1. equals() and equalsIgnoreCase()
    2. regionMatches()
    3. startsWith() and endsWith()
    4. equals() VS ==
    5. compareTo()

equals( ) and equal IgnoreCase( )

- Syntax :

```
boolean equals(String str)      // case sensitive
boolean equalsIgnoreCase ( String str )      // ignore the case
```

- Compares **source** string with target strings **str** for equality.
- returns **true** if the strings contain the **same** characters in the same order, **false** otherwise.
- Example:

```
System.out.println("Hello".equals ("Hello")) // true

System.out.println("Hello".equals ("HELLO")) // false

System.out.println("Hello".equalsIgnoreCase ("HELLO"))  // true
```

regionMatches( )

- *compares* a specific region inside a string with another specific region in another string.
- *It has two overloaded forms:*

```
boolean regionMatches ( int startIndex, String str2, int str2StartIndex, int length)

boolean  regionMatches ( boolean IgnoreCase, int startIndex, String str2, int str2StartIndex,
                                                                    int length)
```

- **Parameter Values**

startIndex	specifies the index at which the region begins within the invoking String object.
str2	The String being compared is specified by str2.
str2StartIndex	The index at which the comparison will start within str2 .

Length	The length of the substring being compared is passed in numChars.
IgnoreCase	if ignoreCase is true, the case of the characters is ignored. Otherwise, case is significant.

- **Example**

```
Class CompareRegion{
        public static void main(String [ ] args){
        String str1 =”Standing at river’s edge”;
        String str2 =”Running at river’s edge”;

        if(str1.regionMatches(9, str2, 8, 12))
                System.out.println(“Regions Matches”);
        If(!str1.regionMatches(0, str2, 0, 12))
                System.out.println(“Regions  do not Match”);
        }
}
```

startsWith( ) and endsWith( )

- The **startsWith**() method determines whether a given String begins with a specified string.
- The **endsWith**() determines whether the String in question ends with a specified string.
- They have the following general forms:

```
boolean  startsWith ( String str )
 boolean  endsWith ( String str )
```

- If *the* string matches, true is returned. Otherwise, false is returned.
- **Example**

```
"Foobar".endsWith("bar");          // true
 "Foobar".startsWith("Foo");       // true
```

equlas( ) vs ==

- **equals( ):** ***Compares the characters*** inside a String object.
- *The* **==** *operator* ***compares the references*** to see ***whether both refer to the same instance.***
- *Example*

```
String s1 = new String ("ABC");
String s2 = new String ("ABC");

System.out.println(s1.equals(s2) ); // true
System.out.println( s1==s2 );  //false
```

compareTo( )

- **Syntax:**

```
int compareTo (String str)
```

- Compares source string with target string **str.**
- The result of the comparison is one of the following:

Value	Meaning
Less than zero	the invoking string is less than str.
Greater than zero	the invoking string is greater than str.
Zero	then the two strings are equal.

- Used in conditions to sort strings
- **Example:**

```
class StringSort {
   public static void main( String args[] ) {

        String list[] = { "Java", "is", "Fun",  "for", "all" };
        for( int j = 0; j < list.length; j++)
```

using indexOf( ) and lastIndexOf( )

- Methods for searching String

int *indexOf* (*searchString*, [*startIndex*])	returns the position of ***first occurrence*** *of* ***searchString***.
int *lastIndexOf* (*searchString*, *start*)	returns the position of ***last occurrence*** *of* ***searchString***.

- *Returns the position of* ***searchString*** *found in source string.*
- *Second parameter is optional which tells position from where search to begin.*
- *Both* method returns **-1** if string is not found.
- *Both methods are case sensitive*
- *Example*

```
String  str = "alpha beta gamma theta zeta"
System.out.prinln(The first index of t is "+str.indexOf('t'); // returns 8
System.out.prinln (The last index of t is "+str.lastIndexOf('t')); // returns 25
```

Changing the case of characters within a string

- Returns a copy of this string converted to lowercase or uppercase.

- If no conversions are necessary, these methods return the original string.
- General form:

String *toLowerCase( )*
String *toUpperCase( )*

- Example:

```
class StringUpperCaseDemo {
        public static void main(String[] args) {
                String name = "Rns";
         System.out.println("Name in Upper Case: " + name.toUpperCase() );
        System.out.println("Name in Lower Case: " + name.toLowerCase() );
        System.out.println("Original name: " + name);
         }
}
```

Output:

```
Name in Upper Case : RNS
Name in Lowercase: Rns
Orinigal Name: Rns
```

Obtaining a modified String

Different methods for searching a string

a) substring()
b) concat()
c) replace()
d) trim()
e) valueOf()

a) substring()

- ***Syntax***

  Form1: **public String substring(**int **beginIndex)**
  Form2: **public String substring(**int **beginIndex,** int **endIndex)**
- returns a new sub string extracted from the source string from index beginIndex till the index specified by endindex .
- *Example:* Write program to check email belongs to which domain (like: gmail, yahoo,rediff .etc)

```
class Demo {
 public static void main(String args[]){
   String email = "Rns@rediffmail.com";

   int startIndex = email.indexOf("@") + 1;
   int lastIndex = email.indexOf(".") ;

   System.out.print("Domain Name :" );
```

b) concat( )

- ***Syntax***:

  String concat (String s)
- appends one String to the end of another.
- Example:

```
String s = "Strings are immutable";
    s = s.concat(" all the time");
    System.out.println(s);
```

c) replace( )

- ***Syntax***

  public String **replace**(char oldChar, char newChar)
- It returns a string derived from this string *by replacing every occurrence of* ***oldChar*** *with* ***newChar.***
- ***Example:***

```
import java.io.*;
public class Test{
  public static void main(String args[]){
    String Str = new String("Welcome to RNSIT");

    System.out.print("Return Value :" );
    System.out.println(Str.replace('o', 'T'));

    System.out.print("Return Value :" );
    System.out.println(Str.replace('l', 'D'));
  }
}
```

d) trim( )

- returns a copy of the string, with leading and trailing whitespace omitted.
- Syntax:

  public String trim()

- **Example:**

```
public class Test{
   public static void main(String args[]){
      String Str = "  Welcome to rnsit.ac.com  ";
      System.out.print("Return Value :" );
      System.out.println(Str.trim( ) );
   }
}
```

e) valueOf( )

- The valueOf method returns the relevant Number Object holding the value of the argument passed. The argument can be a primitive data type, String, etc.
- This method is a static method. The method can take two arguments, where one is a String and the other is a radix.
- Syntax:
- `static Integer valueOf(int i)`
- `static Integer valueOf(String s)`
- Example

```
class Test{
   public static void main(String args[]){

      Integer x =Integer.valueOf(9);
      Double c = Double.valueOf(5);
      Float a = Float.valueOf("80");

      Integer b = Integer.valueOf("444",16);

      System.out.println("x=" + x); // 9
      System.out.println("c=" + c); // 5.0
      System.out.println("a=" + a); //80.0
      System.out.println("b=" + b); //1092
   }
}
```

StringBuffer and String Builder.

- StringBuffer and StringBuilder is a mutable class; means one can change the value of the object

- The object created through StringBuffer and StringBulder is stored in the heap.
- StringBuffer has the same methods as the StringBuilder, but each method in StringBuffer is synchronized
- Due to this it does not allow two threads to simultaneously access the same method. Each method can be accessed by one thread at a time.
- String Buffer can be converted to the string by using

Name	Description
append	Overloaded.
capacity	Returns the current capacity of StringBuffer.
charAt	Returns the character at a specified index.
delete	Deletes the characters within a specified range in a StringBuffer object and returns the new StringBuffer object.
deleteCharAt	Deletes the character at a specified index.
equals	Checks if strings are equal.
getChars	Copies the characters within a specified range from a StringBuffer object to a destination character array at a specified position.
insert	Overloaded.
length	Returns the length of the StringBuffer object.
replace	Replaces characters within a specified range with a specified string.
reverse	Reverses the sequence of the characters in a StringBuffer object.
setCharAt	Changes a character at a specified index in a StringBuffer object.
setLength	Changes the length of a StringBuffer object to a specified length.
substring	Overloaded.
toString	Overridden. Converts a StringBuffer object to a String object.