# Java String Interview Questions with Answers

All of us must have gone though [interview questions](https://howtodoinjava.com/java-interview-questions/) related to [String](https://docs.oracle.com/javase/8/docs/api/java/lang/String.html) class in java. These **String interview questions** range from [immutability](https://en.wikipedia.org/wiki/Immutable_object#Java) to memory leak issues. I will try to cover such questions in this post.

Frequently asked String Interview Questions

1. Is String keyword in Java?

2. Why are strings immutable?

3. What is String constant pool?

4. Keyword 'intern' usage

5. Matching Regular expressions?

6. String comparison with equals() and '=='?

7. Memory leak issue in String class

8. How does String work in Java?

9. What are different ways to create String Object?

10. How to check if String is Palindrome.

11. How to remove or replace characters from String.

12. How to make String upper case or lower case?

13. How to compare two Strings in java program?

14. Can we use String in the switch case?

15. Write a program to print all permutations of String?

16. Write a java program to reverse each word of a given string??

17. How to Split String in java?

18. Why is Char array preferred over String for storing password?

19. Is String thread-safe in Java

20. Why String is popular HashMap key in Java

21. Difference between String, StringBuffer and StringBuilder?

22. How to concatenate multiple strings.

23. How many objects will be created with string initialization code?

24. How do you count the number of occurrences of each character in a string?

25. Write a java program to reverse a string?

# 1. Is String keyword in Java?

NO. String is not a Java reserved keyword. It is a derived type data type i.e. class.

|  |
| --- |
| StringExample.javapublic class StringExample {public static void main(String[] args) {        Integer String = 10;        System.out.println(String);     //Prints 10    } } |

# 2. Why strings are immutable?

We all know that strings in java are [immutable](https://howtodoinjava.com/java/string/java-interview-question-why-strings-are-immutable/). If you want to know, what immutability is and how it is achieved? follow this post: [How to make a java class immutable](https://howtodoinjava.com/java/related-concepts/how-to-make-a-java-class-immutable/)?

Here the question is WHY? Why immutable? Let’s analyze.

1. The very first reason i can think of is ***performance increase***. Java language was developed to speed up the application development as it was not that much fast in previous languages. JVM designers must have been smart enough to identify that real-world applications will consist of mostly Strings in form of labels, messages, configuration, output and such numerous ways.

Seeing such overuse, they imagined how dangerous can be string’s improper use. So they came up with a concept of String pool (next section). String pool is nothing but a collection of some strings mostly unique. The very basic idea behind String pool is to reuse string once created. This way if a particular string is created 20 times in code, application end up having only one instance.

1. Second reason I see as **security considerations**. Strings are most used parameter type in each aspect of java programming. Be it loading a driver or open a URL connection, you need to pass the information as parameter in form of string. If strings have not been final then they have opened up a Pandora box of security issues.All of us must have gone though [interview questions](https://howtodoinjava.com/java-interview-questions/) related to [String](https://docs.oracle.com/javase/8/docs/api/java/lang/String.html) class in java. These questions range from [immutability](https://en.wikipedia.org/wiki/Immutable_object#Java) to memory leak issues. I will try to cover such questions in this post.

Apart from the above two reasons, I didn’t find any convincing answer to this question. If you any something appealing, please share with me.

# 3. String pool concept

String pool is a special memory area separate from regular heap memory where these string constants are stored. These objects are referred string variables during the life cycle of the application.

In Java, String can be created in many ways. Let’s understand them:

#### 1) String assignment

|  |
| --- |
| String str = "abc"; |

Above code causes JVM to verify if there is already a string “abc” (same char sequence). If such string exists, JVM simply assigns the reference of the existing object to variable str, otherwise, a new object “abc” will be created and its reference will be assigned to variable str.

#### 2) Using new keyword

|  |
| --- |
| String str = new String("abc"); |

This version end up **creating two objects in memory**. One object in string pool having char sequence “abc” and second in heap memory referred by variable str and having same char sequence as “abc”.

As java docs says : ***Unless an explicit copy of original is needed, use of this constructor is unnecessary since Strings are immutable.***

# 4. Keyword ‘intern’ usage

When the intern() method is invoked, if the pool already contains a string equal to this String object as determined by the equals(Object) method, then the string from the pool is returned. Otherwise, this String object is added to the pool and a reference to this String object is returned.

|  |
| --- |
| String str = new String("abc");  str.intern(); |

It follows that for any two strings s and t, s.intern() == t.intern() is true if and only if s.equals(t) is true. Means if s and t both are different string objects and have same character sequence, then calling intern() on both will result in single string pool literal referred by both variables.

# 5. Matching Regular expressions

Not so secret but useful feature if you still have not explored it. You must have seen usage of [Pattern](https://docs.oracle.com/javase/6/docs/api/java/util/regex/Pattern.html) and Matcher for regular expression matching. String class provides its own shortcut. Use it directly. This method also uses Pattern.matches() inside function definition.

|  |
| --- |
| String str = new String("abc");  str.matches("<regex>"); |

# 6. String comparison with equals() and ‘==’

Another favorite area in interviews. There are generally two ways to compare objects

* Using == operator
* Using equals() method

**== operator compare for object references** i.e. memory address equality. So if two string objects are referring to same literal in string pool or same string object in heap then s==t will return true, else false.

equals() method is overridden in String class and **it verify the char sequences hold by string objects**. If they store the same char sequence, the s.equals(t) will return true, else false.

# 7. Memory leak issue

Till now we have gone through basic stuff. Now something serious. Have you tried creating substrings from a string object? I bet, Yes. Do you know the internals of substring in java? How they create memory leaks?

Substrings in Java are created using method substring(int beginIndex) and some other overloaded forms of this method. All these methods create a new String object and update the offset and count variable which we saw at the start of this article.

The original value[] is unchanged. Thus if you create a string with 10000 chars and create 100 substrings with 5-10 chars in each, all 101 objects will have the same char array of size 10000 chars. It is memory wastage without any doubt.

Let see this using a program:

*import java.lang.reflect.Field;*

*import java.util.Arrays;*

*public class SubStringTest {*

*public static void main(String[] args) throws Exception*

*{*

*//Our main String*

*String mainString = "i\_love\_java";*

*//Substring holds value 'java'*

*String subString = mainString.substring(7);*

*System.out.println(mainString);*

*System.out.println(subString);*

*//Lets see what's inside mainString*

*Field innerCharArray = String.class.getDeclaredField("value");*

*innerCharArray.setAccessible(true);*

*char[] chars = (char[]) innerCharArray.get(mainString);*

*System.out.println(Arrays.toString(chars));*

*//Now peek inside subString*

*chars = (char[]) innerCharArray.get(subString);*

*System.out.println(Arrays.toString(chars));*

*}*

*}*

*Output:*

*i\_love\_java*

*java*

*[i, \_, l, o, v, e, \_, j, a, v, a]*

*[i, \_, l, o, v, e, \_, j, a, v, a]*

Clearly, both objects have the same char array stored while subString need only four characters.

Let’s solve this issue using our own code:

*import java.lang.reflect.Field;*

*import java.util.Arrays;*

*public class SubStringTest {*

*public static void main(String[] args) throws Exception     {*

*//Our main String*

*String mainString = "i\_love\_java";*

*//Substring holds value 'java'*

*String subString = fancySubstring(7, mainString);*

*System.out.println(mainString);*

*System.out.println(subString);*

*//Lets see what's inside mainString*

*Field innerCharArray = String.class.getDeclaredField("value");*

*innerCharArray.setAccessible(true);*

*char[] chars = (char[]) innerCharArray.get(mainString);*

*System.out.println(Arrays.toString(chars));*

*//Now peek inside subString*

*chars = (char[]) innerCharArray.get(subString);*

*System.out.println(Arrays.toString(chars));*

*}*

*//Our new method prevents memory leakage*

*public static String fancySubstring(int beginIndex, String original)     {*

*return new String(original.substring(beginIndex));*

*}*

*}*

*Output:*

*i\_love\_java*

*java*

*[i, \_, l, o, v, e, \_, j, a, v, a]*

*[j, a, v, a]*

Now substring has only characters which it needs, and intermediate string used to create our correct substring can be garbage collected and thus leaving no memory footprint.

# 8. How String works in Java?

String in Java is like any other programming language, a sequence of characters. This is more like a utility class to work on that char sequence. This char sequence is maintained in the following variable:

/\*\* The value is used for character storage. \*/

private final char value[];

To access this array in different scenarios, the following variables are used:

/\*\* The offset is the first index of the storage that is used. \*/

private final int offset;

/\*\* The count is the number of characters in the String. \*/

# private final int count;

# 10. How to check is String in Palindrome?

A String is said to be [Palindrome](https://en.wikipedia.org/wiki/Palindrome) if it’s value is same when reversed. To check Palindrome, simply reverse the String and check the content of original string and revered String.

*StringExample.java*

*public class StringExample*

*{*

*public static void main(String[] args)*

*{*

*String originalString = "abcdcba";*

*StringBuilder strBuilder = new StringBuilder(originalString);*

*String reverseString = strBuilder.reverse().toString();*

*boolean isPalindrame = originalString.equals(reverseString);*

*System.out.println(isPalindrame);    //true*

*}*

*}*

# 11. How to remove or replace characters from String?

To replace or remove characters, use String.replace() or String.replaceAll(). These methods take two arguments. First argument is character to be replaced, and second argument is new character which will be placed in string.

If you want to remove characters, then pass blank character in the second argument.

*StringExample.java*

*String originalString = "howtodoinjava";*

*//Replace one character*

*System.out.println( originalString.replace("h", "H") );         //Howtodoinjava*

*//Replace all matching characters*

*System.out.println( originalString.replaceAll("o", "O") );      //hOwtOdOinjava*

*//Remove one character*

*System.out.println( originalString.replace("h", "") );         //owtodoinjava*

*//Remove all matching characters*

*System.out.println( originalString.replace("o", "") );         //hwtdinjava*

# 12. How to make String upper case or lower case?

Use String.toLowerCase() and String.toUpperCase() methods to convert string to lowercase or upper case.

|  |
| --- |
| StringExample.java |
| String blogName = "HowToDoInJava.com";  System.out.println(blogName.toLowerCase());     //howtodoinjava.com  System.out.println(blogName.toUpperCase());     //HOWTODOINJAVA.COM |

# 13. How to compare two Strings in java program?

Always use equals() method to verify string equality. Never use "==" operator. Double equal operator always check the object references in memory. equals() method checks the String content.

StringExample.java

*String blogName = "HowToDoInJava.com";*

*String anotherString = new String("HowToDoInJava.com");*

*System.out.println(blogName == anotherString);     //false*

*System.out.println(blogName.equals(anotherString));     //true*

# 14. Can we use String in switch case?

Yes, you can use [String class in switch statements](https://howtodoinjava.com/java7/string-class-is-supported-in-switch-statement-in-java-7/) since Java 7. Before Java 7, it was not possible and you had to use if-else statements to achieve similar behavior.

StringExample.java

*String number = "1";*

*switch (number)*

*{*

*case "1":*

*System.out.println("One");  //Prints '1'*

*break;*

*case "2":*

*System.out.println("Two");*

*break;*

*default:*

*System.out.println("Other");*

# 15. Write a program to print all permutations of String?

A permutation is a re-arrangement of the elements of an ordered list of characters in such a way that each arrangement is unique with respect to other arrangements. e.g. below are the permutations of string “ABC” – ABC ACB BAC BCA CBA CAB.

A string of length N has N! (N Factorial) permutations.

# 16. Write a java program to reverse each word of a given string?

To reverse each word separately, first, tokenize the string and get all words separate in an array. Then apply reverse word logic to each word, and finally concatenate all words.

*StringExample.java*

*String blogName = "how to do in java dot com";*

*//spilt on white space*

*String[] tokens = blogName.split(" ");*

*//It will store reversed words*

*StringBuffer finalString = new StringBuffer();*

*//Loop all words and reverse them*

*for (String token : tokens) {*

*String reversed = new StringBuffer(token).reverse().toString();*

*finalString.append(reversed);*

*finalString.append(" ");*

*}*

*//Check final string*

*System.out.println(finalString.toString());     //woh ot od ni avaj tod moc*

# 17. How to Split String in java?

Use [String.split()](https://howtodoinjava.com/java/string/4-ways-to-split-tokenize-strings-in-java/) method which breaks a given string around matches of the given regular expression. It’s also called get **string tokens based on delimiter**.

split() method returns the array of string. Each string in array is individual token.

|  |
| --- |
| StringExample.java |
| String numbers = "1,2,3,4,5,6,7";  String[] numArray = numbers.split(",");  System.out.println(Arrays.toString(numArray));  //[1, 2, 3, 4, 5, 6, 7] |

# 18. Why Char array is preferred over String for storing password?

We know that strings are stored in the constant pool in Java. Once a string is created in the string pool, it stays in the pool until unless garbage collected. By this time, any malicious program can access the memory location in the physical memory location and access the string as well.

If we store the password as a string, then it will also be stored in spring pool and will be available in memory for the longer duration than required, because garbage collection cycles are unpredictable. This makes sensitive password strings **vulnerable to hacking and data theft**.

Can we make String blank after using it? No, we cannot. We know that once a String is created, we cannot manipulate it e.g. you cannot change its content. Strings are final and immutable.

But char arrays are mutable, their content can be overwritten after use it. So your application shall use char[] to store password text, and after using the password, replace array content with a blank.

*StringExample.java*

*String password = "123456";     //Do not use it*

*char[] passwordChars = new char[4];      //Get password from some system such as database*

*//use password*

*for(char c : passwordChars) {*

*c = ' ';*

*}*

# 19. Is string thread-safe in Java?

Yes, strings are [thread safe](https://howtodoinjava.com/java/multi-threading/what-is-thread-safety/). They are immutable and all immutable instances in java are thread-safe, by default.

# 20. Why String is popular HashMap key in Java?

In Java, A key which has be to used in Map – shall be immutable and should honor the contract between equals()and hashCode() method. String class satisfies both conditions.

Also, String class provides many useful methods to compare, sort, tokenize or lower-upper cases. These methods can be used while performing CRUD operations on Map. It makes it a very useful class to use in Map rather than creating your own class.

# 21. Difference between String, StringBuffer and StringBuilder?

* String class represents a sequence of characters and provides useful methods to work with characters. String class instances are immutable. So each time you perform string concatenation using string class, a new object will be created with the concatenated string.
* StringBuilder class is used to perform string concatenation operations in more memory efficient way. It internally maintains a char array and manipulate the content in this array only.

When you need to get the complete concatenated string after performing all operations, it creates a new String with character array content.

* StringBuffer is very much same as StringBuilder class. Only difference is that it is thread-safe. It’s all methods are synchronized.

# 22. How to concatenate multiple strings?

Use StringBuffer or StringBuilder classes based on you need thread safety or not. Use append() methods in both classes to concatenate strings.

|  |
| --- |
| StringExample.java |
| StringBuffer buffer = new StringBuffer();  buffer.append("how").append("to").append("do").append("in")          .append("java").append(".").append("com");  String blogName = buffer.toString();  System.out.println(blogName); //howtodoinjava.com |

# 23. How many objects will be created with string initialization code?

|  |
| --- |
| StringExample.java |
| String s1 = "howtodoinjava.com";  String s2 = "howtodoinjava.com";  String s3 = new String("howtodoinjava.com"); | |

1. Above code will create **2 objects**.
2. First object will be created in string pool by first statement.
3. Second statement will not create any new object, and s2 will refer to same string constant as s1.
4. Third statement will create a new string object in heap memory.

24. How do you count the number of occurrences of each character in a string?

To find the number of occurrences of each character in a given string, we have used HashMap with the character as a key and it’s occurrences as a value. With each new occurrence, we will increment the value for that character.

StringExample.java

*String blogName = "howtodoinjava.com";*

*HashMap<Character, Integer> occurancesMap = new HashMap<Character, Integer>();*

*char[] strArray = blogName.toCharArray();*

*for (char c : strArray) {*

*if(occurancesMap.containsKey(c))  {*

*occurancesMap.put(c, occurancesMap.get(c)+1);*

*}*

*Else {*

*occurancesMap.put(c, 1);*

*}*

*}*

System.out.println(occurancesMap);

//{a=2, c=1, d=1, h=1, i=1, j=1, m=1, n=1, .=1, o=4, t=1, v=1, w=1}

25. Write a java program to reverse a string without StringBuilder or StringBuffer?

Best way to reverse a string is definitely the StringBuffer.reverse() and StringBuilder.reverse() methods. Still, interviewer may ask you to write your own program, to check your skill level.

Use below-given recursion based example to reverse the string. This program takes the first character from the string and places at the last position in the string. It uses this replacement for all characters in the string until whole string is revered.

*StringExample.java*

*public class StringExample {*

*public static void main(String[] args){*

*String blogName = "howtodoinjava.com";*

*String reverseString = recursiveSwap(blogName);*

*System.out.println(reverseString);*

*}*

*static String recursiveSwap(String str)*

*{*

*if ((null == str) || (str.length() <= 1)){*

*return str;*

*}*

*return recursiveSwap(str.substring(1)) + str.charAt(0);*

*}*

*}*

**Core Java Interview Questions – Part 1**

Are you planning to learn core java? Or an interview is scheduled in coming days? Do not worry and read all **interview questions** given below to refresh your concepts and possibly have some new added in your best of java list.

**Interview Questions List**

[How to create a immutable object in Java? Count all benefits?](https://howtodoinjava.com/interview-questions/core-java-interview-questions-series-part-1/#ques1)

[Is Java Pass by Reference or Pass by Value?](https://howtodoinjava.com/interview-questions/core-java-interview-questions-series-part-1/#ques2)

[What is the use of the finally block? Is finally block in Java guaranteed to be called? When finally block is NOT called?](https://howtodoinjava.com/interview-questions/core-java-interview-questions-series-part-1/#ques3)

[Why there are two Date classes; one in java.util package and another in java.sql?](https://howtodoinjava.com/interview-questions/core-java-interview-questions-series-part-1/#ques4)

[What is Marker interface?](https://howtodoinjava.com/interview-questions/core-java-interview-questions-series-part-1/#ques5)

[Why main() in java is declared as public static void main?](https://howtodoinjava.com/interview-questions/core-java-interview-questions-series-part-1/#ques6)

[What is the difference between creating String as new() and literal?](https://howtodoinjava.com/interview-questions/core-java-interview-questions-series-part-1/#ques7)

[How does substring() inside String works?](https://howtodoinjava.com/interview-questions/core-java-interview-questions-series-part-1/#ques8)

[Explain the working of HashMap.](https://howtodoinjava.com/interview-questions/core-java-interview-questions-series-part-1/#ques9)

[Difference between interfaces and abstract classes?](https://howtodoinjava.com/interview-questions/core-java-interview-questions-series-part-1/#ques10)

[When do you override hashCode and equals()?](https://howtodoinjava.com/interview-questions/core-java-interview-questions-series-part-1/#ques11)

**How to create a immutable object in Java? Count all benefits?**

An immutable class is one whose state can not be changed once created. Here, state of object essentially means the values stored in instance variable in class whether they are primitive types or reference types.

To make a class immutable, below steps needs to be followed:

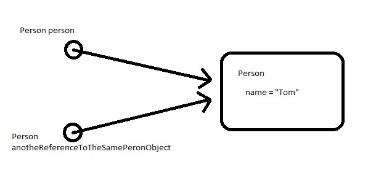
1. Don’t provide “setter” methods or methods that modify fields or objects referred to by fields. Setter methods are meant to change the state of object and this is what we want to prevent here.
2. Make all fields final and private. Fields declared private will not be accessible outside the class and making them final will ensure the even accidentally you can not change them.
3. Don’t allow subclasses to override methods. The simplest way to do this is to declare the class as final. Final classes in java can not be overridden.
4. Always remember that your instance variables will be either mutable or immutable. Identify them and return new objects with copied content for all mutable objects (object references). Immutable variables (primitive types) can be returned safely without extra effort.

Also, you should memorize following benefits of immutable class. You might need them during interview. Immutable classes –

* are simple to construct, test, and use
* are automatically thread-safe and have no synchronization issues
* do not need a copy constructor
* do not need an implementation of clone
* allow hashCode to use lazy initialization, and to cache its return value
* do not need to be copied defensively when used as a field
* make good Map keys and Set elements (these objects must not change state while in the collection)
* have their class invariant established once upon construction, and it never needs to be checked again
* always have “**failure atomicity**” (a term used by Joshua Bloch) : if an immutable object throws an exception, it’s never left in an undesirable or indeterminate state.

Take a look an example written in [**this post**](https://howtodoinjava.com/java/related-concepts/how-to-make-a-java-class-immutable/).

**Is Java Pass by Reference or Pass by Value?**

[](https://howtodoinjava.files.wordpress.com/2013/03/pass-by-value.jpg)The Java Spec says that ***everything in Java is pass-by-value***. There is no such thing as “*pass-by-reference*” in Java. These terms are associated with method calling and passing variables as method parameters. Well, primitive types are always pass by value without any confusion. But, the concept should be understood in context of method parameter of complex types.

In java, when we pass a reference of complex types as any method parameters, always the memory address is copied to new reference variable bit by bit. See in below picture:

In above example, address bits of first instance are copied to another reference variable, thus resulting both references to point a single memory location where actual object is stored. Remember, making another reference to null will not make first reference also null. But, changing state from either reference variable have impact seen in other reference also.

Read in detail here: [**Java Pass by Value or Reference?**](https://howtodoinjava.com/java/related-concepts/java-is-pass-by-value-lets-see-how/)

**What is the use of the finally block? Is finally block in Java guaranteed to be called? When finally block is NOT called?**

The finally block always executes when the try block exits. This ensures that the finally block is executed even if an unexpected exception occurs. But finally is useful for more than just exception handling — it allows having cleanup code accidentally bypassed by a return, continue, or break. Putting cleanup code in a finally block is always a good practice, even when no exceptions are anticipated.

If the JVM exits while the try or catch code is being executed, then the finally block may not execute. Likewise, if the thread executing the try or catch code is interrupted or killed, the finally block may not execute even though the application as a whole continues.

**Why there are two Date classes; one in java.util package and another in java.sql?**

A java.util.Date represents date and time of day, a java.sql.Date only represents a date. The complement of java.sql.Date is java.sql.Time, which only represents a time of day.  
The java.sql.Date is a subclass (an extension) of java.util.Date. So, what changed in java.sql.Date:

– toString() generates a different string representation: **yyyy-mm-dd**  
– a static valueOf(String) methods to create a date from a string with above representation  
– the getters and setter for hours, minutes and seconds are deprecated

The java.sql.Date class is used with JDBC and it was intended to not have a time part, that is, hours, minutes, seconds, and milliseconds should be zero… but this is not enforced by the class.

**Explain marker interfaces?**

The marker interface pattern is a design pattern in computer science, used with languages that **provide run-time type information about objects**. It provides **a means to associate metadata with a class where the language does not have explicit support for such metadata.** In java, it is used as interfaces with no method specified.

A good example of use of marker interface in java is [Serializable](https://howtodoinjava.com/java/serialization/a-mini-guide-for-implementing-serializable-interface-in-java/) interface. A class implements this interface to indicate that its non-transient data members can be written to a byte steam or file system.

A *major problem* with marker interfaces is that an interface defines a contract for implementing classes, and that contract is inherited by all subclasses. This means that **you cannot “un-implement” a marker**. In the example given, if you create a subclass that you do not want to serialize (perhaps because it depends on transient state), you must resort to explicitly throwing NotSerializableException.

**Why main() in java is declared as public static void?**

***Why public*?** main method is public so that it can be accessible everywhere and to every object which may desire to use it for launching the application. Here, i am not saying that JDK/JRE had similar reasons because java.exe or javaw.exe (for windows) use Java Native Interface (JNI) calls to invoke method, so they can have invoked it either way irrespective of any access modifier.

***Why static*?** Lets suppose we do not have main method as static. Now, to invoke any method you need an instance of it. Right? Java can have overloaded constructors, we all know. Now, which one should be used and from where the parameters for overloaded constructors will come.

***Why void*?** Then there is no use of returning any value to JVM, who actually invokes this method. The only thing application would like to communicate to invoking process is: normal or abnormal termination. This is already possible using System.exit(int). A non-zero value means abnormal termination otherwise everything was fine.

**What is the difference between creating String as new() and literal?**

When we create String with new() it’s created in heap and also added into string pool, while String created using literal are created in String pool only which exists in Perm area of heap.

Well you really need to know the concept of string pool very deeply to answer this question or similar questions. My advise.. “Study Hard” about [string class and string pool](https://howtodoinjava.com/java/string/interview-stuff-about-string-class-in-java/).

**How does substring () inside String works?**

String in java are like any other programming language, a sequence of characters. This is more like a utility class to work on that char sequence. This char sequence is maintained in following variable:

/\*\* The value is used for character storage. \*/  
**private final char value[];**

To access this array in different scenarios, following variables are used:

/\*\* The offset is the first index of the storage that is used. \*/  
**private final int offset;**

/\*\* The count is the number of characters in the String. \*/  
**private final int count;**

Whenever we create a substring from any existing string instance, substring() method only set’s the new values of offset and count variables. The internal char array is unchanged. This is a possible source of memory leak if substring() method is used without care. [Read more here](https://howtodoinjava.com/java/string/interview-stuff-about-string-class-in-java/)

**Explain the working of HashMap. How duplicate collision is resolved?**

Most of you will agree that HashMap is most favorite topic for discussion in interviews now-a-days. If anybody asks me to describe “How HashMap works?”, I simply answer: “**On principles of Hashing**“. As simple as it is.

Now, Hashing in its simplest form, is a way to assigning a unique code for any variable/object after applying any formula/ algorithm on its properties.

**A map by definition is : “An object that maps keys to values”**. Very easy.. right? So, HashMap has an inner class Entry, which looks like this:

|  |
| --- |
| static class Entry<k ,V> implements Map.Entry<k ,V>  {  final K key;  V value;  Entry<k ,V> next;  final int hash;  ...//More code goes here  } |

When, someone tries to store a key value pair in a HashMap, following things happen:

* First of all, key object is checked for null. If key is null, value is stored in table[0] position. Because hash code for null is always 0.
* Then on next step, a hash value is calculated using key’s hash code by calling its hashCode() method. This hash value is used to calculate index in array for storing Entry object. JDK designers well assumed that there might be some poorly written hashCode() functions that can return very high or low hash code value. To solve this issue, they introduced another hash() function, and passed the object’s hash code to this hash() function to bring hash value in range of array index size.
* Now indexFor(hash, table.length) function is called to calculate exact index position for storing the Entry object.
* Here comes the main part. Now, as we know that two unequal objects can have same hash code value, how two different objects will be stored in same array location [called bucket]. Answer is LinkedList. If you remember, Entry class had an attribute “next”. This attribute always points to next object in chain. This is exactly the behavior of LinkedList.

So, in case of collision, Entry objects are stored in LinkedList form. When an Entry object needs to be stored in particular index, HashMap checks whether there is already an entry?? If there is no entry already present, Entryobject is stored in this location.

If there is already an object sitting on calculated index, its next attribute is checked. If it is **null**, and current Entry object becomes next node in LinkedList. If next variable is not null, procedure is followed until next is evaluated as null.

What if we add the another value object with same key as entered before. Logically, it should replace the old value. How it is done? Well, after determining the index position of Entry object, while iterating over LinkedList on calculated index, HashMap calls equals() method on key object for each Entry object. All these Entry objects in LinkedList will have similar hash code but equals() method will test for true equality. If **key.equals(k)** will be true then both keys are treated as same key object. This will cause the replacing of value object inside Entry object only.

In this way, HashMap ensure the uniqueness of keys.

**Difference between interfaces and abstract classes?**

This is very common question if you are appearing interview for junior level programmer. Well, most noticeable differences are as below:

* Variables declared in a Java interface is by default final. An abstract class may contain non-final variables.
* Java interface are implicitly abstract and cannot have implementations. A Java abstract class can have instance methods that implements a default behavior.
* Members of a Java interface are public by default. A Java abstract class can have the usual flavors of class members like private, abstract.
* Java interface should be implemented using keyword “**implements**“; A Java abstract class should be extended using keyword “**extends**“.
* A Java class can implement multiple interfaces but it can extend only one abstract class.
* Interface is  cannot be instantiated; A Java abstract class also cannot be instantiated, but can be invoked if a main() exists. Since Java 8, you can define [**default methods in interfaces**](https://howtodoinjava.com/java8/default-methods-in-java-8/).
* Abstract class are slightly faster than interface because interface involves a search before calling any overridden method in Java. This is not a significant difference in most of cases but if you are writing a time critical application than you may not want to leave any stone unturned.

**When do you override hashCode() and equals()?**

hashCode() and equals() methods have been defined in Object class which is parent class for java objects. For this reason, all java objects inherit a default implementation of these methods.

hashCode() method is used to get a unique integer for given object. This integer is used for determining the bucket location, when this object needs to be stored in some HashTable like data structure. By default, Object’s hashCode()method returns and integer representation of memory address where object is stored.  
equals() method, as name suggest, is used to simply verify the equality of two objects. Default implementation simply check the object references of two objects to verify their equality.

Note that it is generally necessary to override the hashCode method whenever this method is overridden, so as to maintain the general contract for the hashCode() method, which states that equal objects must have equal hash codes.

* equals() must define an equality relation (it must be **reflexive, symmetric and transitive**). In addition, it must be consistent (if the objects are not modified, then it must keep returning the same value). Furthermore, o.equals(null) must always return false.
* hashCode() must also be consistent (if the object is not modified in terms of equals(), it must keep returning the same value).

The relation between the two methods is:

Whenever a.equals(b) then a.hashCode() must be same as b.hashCode().