Strings are one of the most important and commonly used data types in Java. They are objects that represent sequences of characters, such as words or sentences. Let's explore Strings in Java step by step.

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1. What is a String in Java?

- **String** in Java is a **class** (from `java.lang.String`), but it is used as if it's a data type.
- Strings are **immutable**, meaning once created, their values cannot be changed. Any modification creates a new String object.

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2. Creating Strings

Strings can be created in two ways:

a. Using String Literals (Preferred Way)

```
String name = "Hello, World!";
```

- The JVM checks if the same literal already exists in the **String Pool**. If it does, it reuses the object to save memory.

b. Using the `new` Keyword

```
String name = new String("Hello, World!");
```

- This creates a new String object in memory, even if the same value already exists in the String Pool.

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3. Common String Methods

Here are some of the most commonly used methods in the `String` class:

Method	Description	Example
`length()`	Returns the length of the string.	`"Hello".length()` → `5`
`charAt(int index)`	Returns the character at the specified index (0-based).	`"Hello".charAt(1)` → `e`
`substring(int start, int end)`	Extracts a substring from the string.	`"Hello".substring(1, 4)` → `ell`
`contains(CharSequence s)`	Checks if the string contains a specific sequence of characters.	`"Hello".contains("el")` → `true`
`equals(Object obj)`	Compares two strings for equality (case-sensitive).	`"Hello".equals("hello")` → `false`

Method	Description	Example
`equalsIgnoreCase(String)`	Compares strings for equality (case-insensitive).	`"Hello".equalsIgnoreCase("hello")` → `true`
`toUpperCase()`	Converts the string to uppercase.	`"Hello".toUpperCase()` → `HELLO`
`toLowerCase()`	Converts the string to lowercase.	`"Hello".toLowerCase()` → `hello`
`trim()`	Removes leading and trailing whitespaces.	`" Hello ".trim()` → `Hello`
`replace(char, char)`	Replaces all occurrences of a character.	`"Hello".replace('e', 'a')` → `Hallo`
`split(String regex)`	Splits the string into an array of substrings using a delimiter.	`"a,b,c".split(",")` → `["a", "b", "c"]`

4. Example: Exploring String Methods

```java
public class StringExample {
    public static void main(String[] args) {
        String text = "  Hello, Java World!  ";

        // Length
        System.out.println("Length: " + text.length());

        // Trim
        String trimmed = text.trim();
```

```
        System.out.println("Trimmed: " + trimmed);

        // Substring
        System.out.println("Substring: " + trimmed.substring(7, 11)); // Output:
Java

        // Upper and Lower Case
        System.out.println("Uppercase: " + trimmed.toUpperCase());
        System.out.println("Lowercase: " + trimmed.toLowerCase());

        // Replace
        System.out.println("Replace 'Java' with 'Python': " +
trimmed.replace("Java", "Python"));

        // Contains
        System.out.println("Contains 'World': " + trimmed.contains("World"));

        // Split
        String[] words = trimmed.split(" ");
        System.out.println("Words in String:");
        for (String word : words) {
            System.out.println(word);
        }
    }
}
```

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5. Comparing Strings

In Java, you should **never use `==` to compare strings**. Use `equals()` or `equalsIgnoreCase()` instead.

Why?

- The `==` operator checks if two string objects reference the same memory location.
- `equals()` checks if the content of the strings is the same.

Example

```
public class StringComparison {
    public static void main(String[] args) {
        String str1 = "Hello";
        String str2 = new String("Hello");

        // Using ==
        System.out.println(str1 == str2); // Output: false

        // Using equals()
        System.out.println(str1.equals(str2)); // Output: true
```

```
    }
}
```

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6. String Immutability

Strings in Java are immutable. Any operation that modifies a string (like `concat`, `replace`, etc.) creates a new string.

Example

```
public class StringImmutability {
    public static void main(String[] args) {
        String str = "Hello";
        str.concat(" World"); // Concatenates, but doesn't update 'str'

        System.out.println(str); // Output: Hello

        str = str.concat(" World"); // Update 'str' with the new value
        System.out.println(str); // Output: Hello World
    }
}
```

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7. StringBuilder and StringBuffer

For mutable strings (strings you want to modify frequently), use **StringBuilder** or **StringBuffer**. These are more efficient for repeated modifications.

Key Differences

- **StringBuilder**: Faster, but not thread-safe.
- **StringBuffer**: Thread-safe, but slower due to synchronization.

Example: StringBuilder

```
public class StringBuilderExample {
    public static void main(String[] args) {
        StringBuilder sb = new StringBuilder("Hello");
        sb.append(" World");
        System.out.println(sb); // Output: Hello World
```

```
    }
}
```

What Next?

- Try solving small problems with strings (e.g., reversing a string, checking for palindromes).
- Work with `StringBuilder` for performance-sensitive tasks.

Would you like some challenges or examples involving strings? 😊