final Keyword in Java

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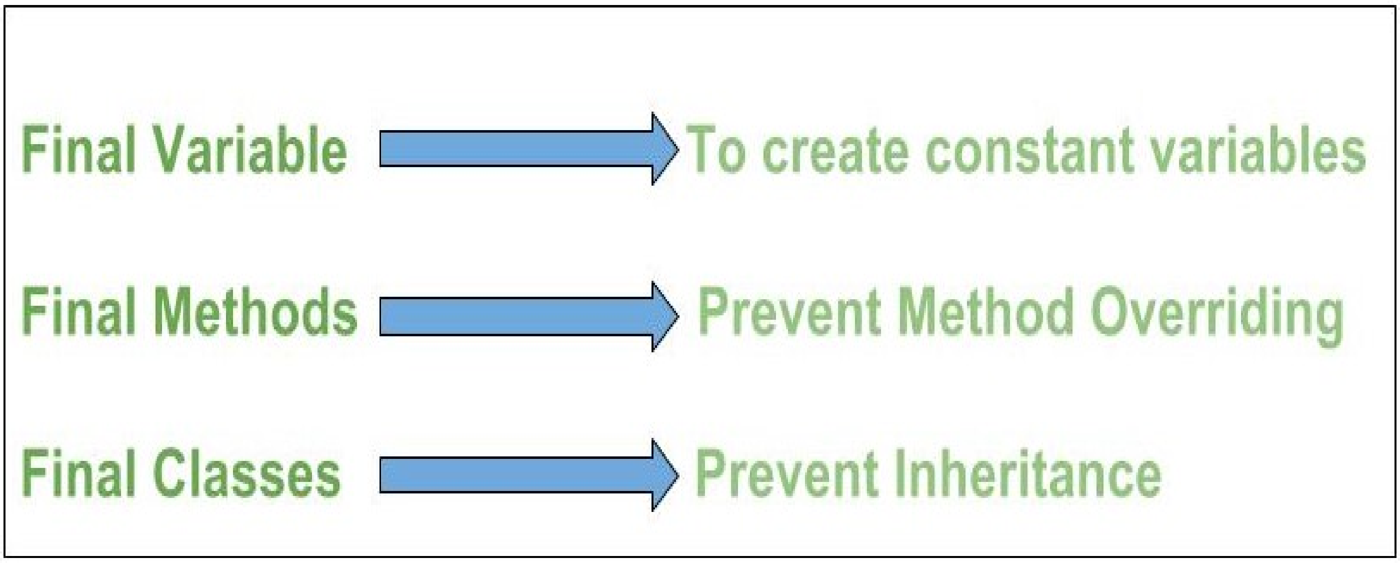
final keyword is used in different contexts. First of all, *final* is a non-access modifier applicable **only to a variable, a method or a class**. Following are different contexts where final is used.



Final Variables

When a variable is declared with *final* keyword, its value can't be modified, essentially, a constant. This also means that you must initialize a final variable. If the final variable is a reference, this means that the variable cannot be re-bound to reference another object, but the internal state of the object pointed by that reference variable can be changed i.e. you can add or remove elements from the final array or final collection. It is good practice to represent final variables in all uppercase, using underscore to separate words.

Illustration:

```
// a final variable
final int THRESHOLD = 5;


// a blank final variable
final int THRESHOLD;


// a final static variable PI
static final double PI = 3.141592653589793;
```

```
// a  blank final static  variable
static final double PI;
```

Initializing a final Variable

We must initialize a final variable, otherwise, the compiler will throw a compile-time error. A final variable can only be initialized once, either via an initializer or an assignment statement. There are three ways to initialize a final variable:

1. You can initialize a final variable when it is declared. This approach is the most common. A final variable is called a **blank final variable** if it is **not** initialized while declaration. Below are the two ways to initialize a blank final variable.
2. A blank final variable can be initialized inside an instance-initializer block or inside the constructor. If you have more than one constructor in your class then it must be initialized in all of them, otherwise, a compile-time error will be thrown.
3. A blank final static variable can be initialized inside a static block.

Let us do discuss out these two different ways of initializing a final variable

Example:

```java
// Java Program to demonstrate Different
// Ways of Initializing a final Variable

// Main class
class GFG {

    // a final variable
    // direct initialize
    final int THRESHOLD = 5;

    // a blank final variable
    final int CAPACITY;

    // another blank final variable
    final int  MINIMUM;

    // a final static variable PI
    // direct initialize
    static final double PI = 3.141592653589793;

    // a  blank final static  variable
    static final double EULERCONSTANT;

    // instance initializer block for
    // initializing CAPACITY
    {
        CAPACITY = 25;
    }

    // static initializer block for
    // initializing EULERCONSTANT
    static{
        EULERCONSTANT = 2.3;
    }

    // constructor for initializing MINIMUM
    // Note that if there are more than one
    // constructor, you must initialize MINIMUM
    // in them also
    public GFG()
    {
        MINIMUM = -1;
    }

}
```

Geeks there was no main method in the above code as it was simply for illustration purposes to get a better understanding in order to draw conclusions:

Observation 1: When to use a final variable?

The only difference between a normal variable and a final variable is that we can re-assign the value to a normal variable but we cannot change the value of a final variable once assigned. Hence final variables must be used only for the values that we want to remain constant throughout the execution of the program.

Observation 2: Reference final variable?

When a final variable is a reference to an object, then this final variable is called the reference final variable. For example, a final StringBuffer variable looks like defined below as follows:

```
final StringBuffer sb;
```

As we all know that a final variable cannot be re-assign. But in the case of a reference final variable, the internal state of the object pointed by that reference variable can be changed. Note that this is not re-assigning. This property of *final* is called *non-transitivity*. To understand what is meant by the internal state of the object as shown in the below example as follows:

Example

```java
// Java Program to demonstrate
// Reference of Final Variable

// Main class
class GFG {

    // Main driver method
    public static void main(String[] args)
    {
        // Creating sn object of StringBuilder class
        // Final reference variable
        final StringBuilder sb = new StringBuilder("Geeks");

        // Printing the element in StringBuilder object
        System.out.println(sb);

        // changing internal state of object reference by
        //  final reference variable sb
        sb.append("ForGeeks");

        // Again printing the element in StringBuilder
        // object after appending above element in it
        System.out.println(sb);
    }
}
```

Output

```
Geeks
GeeksForGeeks
```

The *non-transitivity* property also applies to arrays, because arrays are objects in java. Arrays with the **final keyword** are also called final arrays.

Note: *As discussed above, a final variable cannot be reassign, doing it will throw co mpile-time error.*

Example:

```java
// Java Program to Demonstrate Re-assigning
// Final Variable will throw Compile-time Error

// Main class
class GFG {

    // Declaring and customly initializing static final
    // variable
    static final int CAPACITY = 4;

    // Main driver method
    public static void main(String args[])
    {
        // Re-assigning final variable
        // will throw compile-time error
        CAPACITY = 5;
    }
}
```

Output:

```
prog.java:16: error: cannot assign a value to final variable CAPACITY
        CAPACITY = 5;
        ^
1 error
```

Remember: *When a final variable is created inside a method/constructor/block, it is called local final variable, and it must initialize once where it is created. See below p rogram for local final variable.*

Example

```
// Java program to demonstrate
// local final variable

// Main class
class GFG {

    // Main driver method
    public static void main(String args[])
    {
        // Declaring local final variable
        final int i;

        // Now initializing it with integer value
        i = 20;

        // Printing the value on console
        System.out.println(i);
    }
}
```

Output

```
20
```

Geeks do remember the below key points as perceived before moving forward as listed below as follows:

1. Note the difference between C++ *const* variables and Java *final* variables. const variables in C++ must be assigned a value when declared. For final variables in Java, it is not necessary as we see in the above examples. A final variable can be assigned value later, but only once.
2. *final* with foreach loop: final with for-each statement is a legal statement.

Example

```
// Java Program to demonstrate Final
// with for-each Statement

// Main class
class GFG {

    // Main driver method
    public static void main(String[] args)
    {

        // Declaring and initializing
        // custom integer array
        int arr[] = { 1, 2, 3 };

        // final with for-each statement
        // legal statement
        for (final int i : arr)
            System.out.print(i + " ");
    }
}
```

Output

```
1 2 3
```

Output explanation:

Since the "*i*" variable goes out of scope with each iteration of the loop, it is actually re-declaration each iteration, allowing the same token (i.e. i) to be used to represent multiple variables.

Final classes

When a class is declared with *final* keyword, it is called a final class. A final class cannot be extended(inherited).

There are two uses of a final class:

Usage 1: One is definitely to prevent inheritance, as final classes cannot be extended. For example, all Wrapper Classes like Integer, Float, etc. are final classes. We can not extend them.

```
final class A
{
     // methods and fields
}
// The following class is illegal
class B extends A
{
    // COMPILE-ERROR! Can't subclass A
}
```

Usage 2: The other use of final with classes is to create an immutable class like the predefined String class. One can not make a class immutable without making it final.

Final Methods

When a method is declared with *final* keyword, it is called a final method. A final method cannot be overridden. The Object class does this—a number of its methods are final. We must declare methods with the final keyword for which we are required to follow the same implementation throughout all the derived classes.

Illustration: Final keyword with a method

```
class A
{
    final void m1()
    {
        System.out.println("This is a final method.");
    }
}

class B extends A
{
    void m1()
    {
        // Compile-error! We can not override
        System.out.println("Illegal!");
    }
}
```

For more examples and behavior of final methods and final classes, please see Using final with inheritance. Please see the abstract in java article for differences between the final and abstract.

Related Interview Question(Important): Difference between final, finally, and finalize in Java