**SINGLETON PATTERN**

* Singleton pattern restricts the instantiation of a class and ensures that only one instance of the class exists in the java virtual machine.
* The singleton class must provide a global access point to get the instance of the class.
* Singleton pattern is used for logging, drivers objects, caching and [thread pool](https://www.journaldev.com/1069/threadpoolexecutor-java-thread-pool-example-executorservice).
* Singleton design pattern is also used in other design patterns like [Abstract Factory](https://www.journaldev.com/1418/abstract-factory-design-pattern-in-java), [Builder](https://www.journaldev.com/1425/builder-design-pattern-in-java), [Prototype](https://www.journaldev.com/1440/prototype-design-pattern-in-java), [Facade](https://www.journaldev.com/1557/facade-design-pattern-in-java) etc.

To implement a Singleton pattern, we have different approaches but all of them have the following common concepts.

* Private constructor to restrict instantiation of the class from other classes.
* Private static variable of the same class that is the only instance of the class.
* Public static method that returns the instance of the class, this is the global access point for outer world to get the instance of the singleton class.
* **Eager initialization**

In eager initialization, the instance of Singleton Class is created at the time of class loading, this is the easiest method to create a singleton class but it has a drawback that instance is created even though client application might not be using it.

public class EagerInitializedSingleton {

private static final EagerInitializedSingleton instance=new EagerInitializedSingleton();

private EagerInitializedSingleton(){}

public static EagerInitializedSingleton getInstance(){

return instance; }}

**Static block initialization**

[Static block](https://www.journaldev.com/1365/static-keyword-in-java) initialization implementation is similar to eager initialization, except that instance of class is created in the static block that provides option for [exception handling](https://www.journaldev.com/1696/exception-handling-in-java).

public class StaticBlockSingleton {

private static StaticBlockSingleton instance;

private StaticBlockSingleton(){}

//static block initialization for exception handling

static{

try{

instance = new StaticBlockSingleton();

}catch(Exception e){

throw new RuntimeException("Exception occured in creating singleton instance");

}

}

public static StaticBlockSingleton getInstance(){

return instance;

}

}

### Lazy Initialization

Lazy initialization method to implement Singleton pattern creates the instance in the global access method. Here is the sample code for creating Singleton class with this approach.

public class LazyInitializedSingleton {

private static LazyInitializedSingleton instance;

private LazyInitializedSingleton(){}

public static LazyInitializedSingleton getInstance(){

if(instance == null){

instance = new LazyInitializedSingleton();

}

return instance;

}

}

The above implementation works fine in case of the single-threaded environment but when it comes to multithreaded systems, it can cause issues if multiple threads are inside the if condition at the same time. It will destroy the singleton pattern and both threads will get the different instances of the singleton class.

### Thread Safe Singleton

The easier way to create a thread-safe singleton class is to make the global access method [synchronized](https://www.journaldev.com/1061/thread-safety-in-java), so that only one thread can execute this method at a time.

public class ThreadSafeSingleton {

private static ThreadSafeSingleton instance;

private ThreadSafeSingleton(){}

public static synchronized ThreadSafeSingleton getInstance(){

if(instance == null){

instance = new ThreadSafeSingleton();

}

return instance;

}

}

To avoid this extra overhead every time, **double checked locking** principle is used. In this approach, the synchronized block is used inside the if condition with an additional check to ensure that only one instance of a singleton class is created.

public static ThreadSafeSingleton getInstanceUsingDoubleLocking(){

if(instance == null){

synchronized (ThreadSafeSingleton.class) {

if(instance == null){

instance = new ThreadSafeSingleton();

}

}

}

return instance;

}