Types of References in Java

In Java there are four types of references differentiated on the way by which they are garbage collected.

1. Strong References
2. Weak References
3. Soft References
4. Phantom References

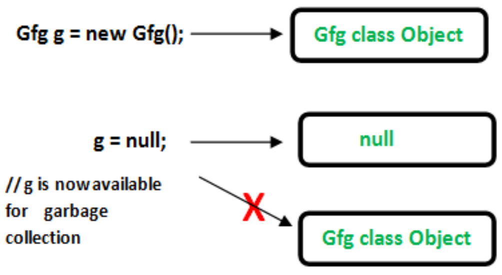
Prerequisite: Garbage Collection

- **Strong References:** This is the default type/class of Reference Object. Any object which has an active strong reference are not eligible for garbage collection. The object is garbage collected only when the variable which was strongly referenced points to null.

```
 MyClass obj = new MyClass ();
```

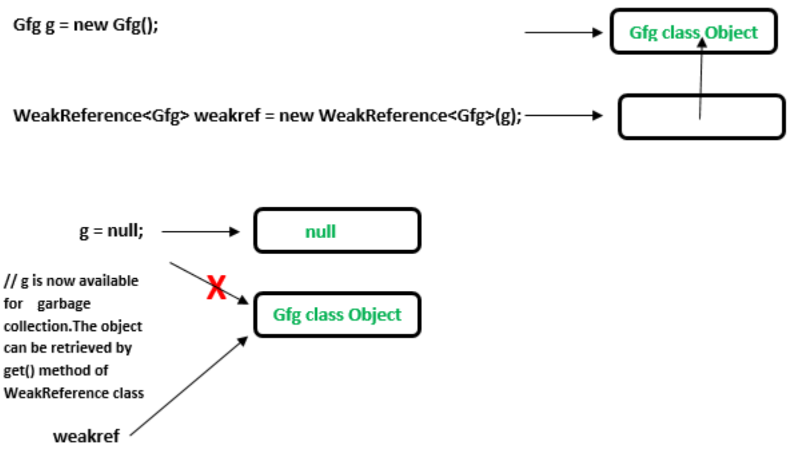
Here 'obj' object is strong reference to newly created instance of MyClass, currently obj is active object so can't be garbage collected.

```
 obj = null;
 //'obj' object is no longer referencing to the instance.
 So the 'MyClass type object is now available for garbage collection.
```



```
// Java program to illustrate Strong reference
class Gfg
{
    //Code..
}
public class Example
{
    public static void main(String[] args)
    {
         //Strong Reference - by default
        Gfg g = new Gfg();

        //Now, object to which 'g' was pointing earlier is
        //eligible for garbage collection.
        g = null;
    }
}
```

- **Weak References:** Weak Reference Objects are not the default type/class of Reference Object and they should be explicitly specified while using them.
    - This type of reference is used in WeakHashMap to reference the entry objects .
    - If JVM detects an object with only weak references (i.e. no strong or soft references linked to any object object), this object will be marked for garbage collection.
    - To create such references java.lang.ref.WeakReference class is used.
    - These references are used in real time applications while establishing a DBConnection which might be cleaned up by Garbage Collector when the application using the database gets closed.


Gfg g = new Gfg();
Gfg class Object
WeakReference<Gfg> weakref = new WeakReference<Gfg>(g);
g = null;
null
// g is now available for garbage collection.The object can be retrieved by get() method of WeakReference class
Gfg class Object
weakref

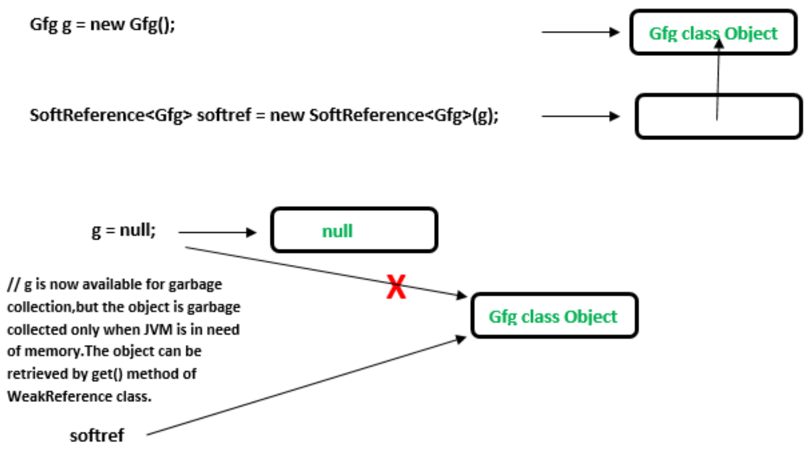
```
//Java Code to illustrate Weak reference
import java.lang.ref.WeakReference;
class Gfg
{
    //code
    public void x()
    {
        System.out.println("GeeksforGeeks");
    }
}

public class Example
{
    public static void main(String[] args)
    {
        // Strong Reference
        Gfg g = new Gfg();
        g.x();

        // Creating Weak Reference to Gfg-type object to which 'g'
        // is also pointing.
        WeakReference<Gfg> weakref = new WeakReference<Gfg>(g);

        //Now, Gfg-type object to which 'g' was pointing earlier
        //is available for garbage collection.
        //But, it will be garbage collected only when JVM needs memory.
        g = null;

        // You can retrieve back the object which
        // has been weakly referenced.
        // It succesfully calls the method.
        g = weakref.get();

        g.x();
    }
}
```

Output:

```
GeeksforGeeks
GeeksforGeeks
```

Two different levels of weakness can be enlisted: Soft and Phantom

- **Soft References:** In Soft reference, even if the object is free for garbage collection then also its not garbage collected, until JVM is in need of memory badly.The objects gets cleared from the memory when JVM runs out of memory.To create such references java.lang.ref.SoftReference class is used.



Gfg g = new Gfg();
Gfg class Object
SoftReference<Gfg> softref = new SoftReference<Gfg>(g);
g = null;
null
// g is now available for garbage collection,but the object is garbage collected only when JVM is in need of memory.The object can be retrieved by get() method of WeakReference class.
X
Gfg class Object
softref

```java
//Code to illustrate Soft reference
import java.lang.ref.SoftReference;
class Gfg
{
    //code..
    public void x()
    {
        System.out.println("GeeksforGeeks");
    }
}

public class Example
{
    public static void main(String[] args)
    {
        // Strong Reference
        Gfg g = new Gfg();
        g.x();

        // Creating Soft Reference to Gfg-type object to which 'g'
        // is also pointing.
        SoftReference<Gfg> softref = new SoftReference<Gfg>(g);

        // Now, Gfg-type object to which 'g' was pointing
        // earlier is available for garbage collection.
        g = null;

        // You can retrieve back the object which
        // has been weakly referenced.
        // It succesfully calls the method.
        g = softref.get();

        g.x();
    }
}
```

Output:

```
GeeksforGeeks
GeeksforGeeks
```

- **Phantom References:** The objects which are being referenced by phantom references are eligible for garbage collection. But, before removing them from the memory, JVM puts them in a queue called 'reference queue' . They are put in a reference queue after calling finalize() method on them.To create such references java.lang.ref.PhantomReference class is used.

```java
//Code to illustrate Phantom reference
```

```java
import java.lang.ref.*;
class Gfg
{
    //code
    public void x()
    {
        System.out.println("GeeksforGeeks");
    }
}

public class Example
{
    public static void main(String[] args)
    {
        //Strong Reference
        Gfg g = new Gfg();
        g.x();

        //Creating reference queue
        ReferenceQueue<Gfg> refQueue = new ReferenceQueue<Gfg>();

        //Creating Phantom Reference to Gfg-type object to which 'g'
        //is also pointing.
        PhantomReference<Gfg> phantomRef = null;

        phantomRef = new PhantomReference<Gfg>(g,refQueue);

        //Now, Gfg-type object to which 'g' was pointing
        //earlier is available for garbage collection.
        //But, this object is kept in 'refQueue' before
        //removing it from the memory.
        g = null;

        //It always returns null.
        g = phantomRef.get();

        //It shows NullPointerException.
        g.x();
    }
}
```

Runtime Error:

```
Exception in thread "main" java.lang.NullPointerException
        at Example.main(Example.java:31)
```

Output:

```
GeeksforGeeks
```

This article is contributed by **Pratik Agarwal**. If you like GeeksforGeeks and would like to contribute, you can also write an article using contribute.geeksforgeeks.org or mail your article to contribute@geeksforgeeks.org. See your article appearing on the GeeksforGeeks main page and help other Geeks.

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