	Course Name: Design Patterns/Thinking LAB	**EXPERIMENT NO. 5**	
	Course Code: 20CP210P **Faculty: Dr. Ketan Sabale**	**Branch: CSE**	**Semester: IV**
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Objective: To familiarize students with standard Creational design patterns.

Experiment: Explain the singleton design pattern and write a program using any object-oriented programming language to demonstrate the working of singleton design pattern.

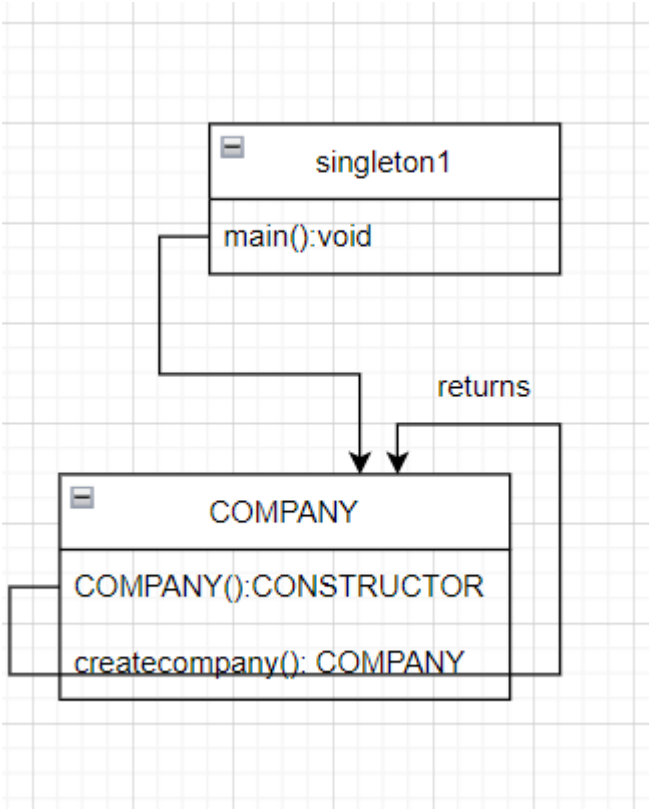
Theory : Imagine a Scenario when there is Object which needs to be created only once due to some reason . So how to implement it . There are majorly 5 ways in which this can be implemented.

In the way 1 we create a object of the class and we create it's constructor declared as private . then we can create a method which is of Return type of the object and it will return the obj so even if the method is called more than once only one object is created.

Problem Statement Explanation:

Imagine we are Government Body which is responsible to give trademark to companies and there is a rule that only one company can get a trademark of a particular name . in that application singleton method can be used that if company is created then new object can't be created.

Flowchart Explanation:



Method 1: Eager Instantiation

Code:

```
public class singleton1 {
    public static void main(String[] args) {
        COMPANY ATPL = COMPANY.createcompany();
        COMPANY ATPL = COMPANY.createcompany();
    }
}
class COMPANY {
    static COMPANY ATPL = new COMPANY();

    private COMPANY() {
        System.out.println("COMPANY CREATED SUCCESFULLY");
    }

    public static COMPANY createcompany() {
        return ATPL;
    }
}
```

Output:

```
PS C:\Users\onlyf\OneDrive\Desktop\PDEU\Sem4\Design Pattern\Singleton> cd "c
gleton1.java } ; if ($?) { java singleton1 }
COMPANY CREATED SUCCESFULLY
PS C:\Users\onlyf\OneDrive\Desktop\PDEU\Sem4\Design Pattern\Singleton>
```

Method 2: Lazy Instantiation

Limitation of Method1 : we can't get to know that if a object is already created or not

Code:

```
public class singleton2 {
    public static void main(String[] args) {
        COMPANY ATPL = COMPANY.createcompany();
        COMPANY AMUL = COMPANY.createcompany();
    }
}

class COMPANY {
    static COMPANY obj;

    private COMPANY() {
        System.out.println("COMPANY CREATED SUCESSFULLY");
    }

    public static COMPANY createcompany() {
        if (obj == null) {
            obj = new COMPANY();
        }
        return obj;
    }
}
```

Output:

```
PS C:\Users\onlyf\OneDrive\Desktop\PDEU\Sem4\Design Patter
n\Singleton> cd "c:\Users\onlyf\OneDrive\Desktop\PDEU\Sem4
\Design Pattern\Singleton\" ; if ($?) { javac singleton2.j
ava } ; if ($?) { java singleton2 }
COMPANY CREATED SUCESSFULLY
PS C:\Users\onlyf\OneDrive\Desktop\PDEU\Sem4\Design Patter
n\Singleton>
```

Method 3: Synchronized

Limitation of Method2 : If we create many thread's which access the method parallelly then many objects of same can be created

Code:

```
public class singleton3 {
    public static void main(String[] args) {
        Thread t1 = new Thread(
                new Runnable() {
                    public void run() {
                        COMPANY ATPL = COMPANY.createcompany();
                    }
                });
        Thread t2 = new Thread(
                new Runnable() {
                    public void run() {
                        COMPANY AMUL = COMPANY.createcompany();
                    }
                });
        t1.start();
        t2.start();
    }}
class COMPANY {
    static COMPANY obj;
    private COMPANY() {
        System.out.println("COMPANY CREATED SUCESSFULLY");
    }
    public static synchronized COMPANY createcompany() {
        if (obj == null) {
            obj = new COMPANY();
        }
        return obj;
    }}
```

Output:

```
PS C:\Users\onlyf\OneDrive\Desktop\PDEU\Sem4\Design Patter
n\Singleton> cd "c:\Users\onlyf\OneDrive\Desktop\PDEU\Sem4
\Design Pattern\Singleton\" ; if ($?) { javac singleton3.j
ava } ; if ($?) { java singleton3 }
COMPANY CREATED SUCESSFULLY
PS C:\Users\onlyf\OneDrive\Desktop\PDEU\Sem4\Design Patter
n\Singleton>
```

Method 4: Double Checked Locking

Limitation of Method3 : If we mark whole method as synchronized the task other then creating object also have to wait for one thread to complete it's process

Code:

```
public class singleton4 {
    public static void main(String[] args) {
        Thread t1 = new Thread(
                new Runnable() {
                    public void run() {
                        COMPANY ATPL = COMPANY.createcompany();
                    }
                });
        Thread t2 = new Thread(
                new Runnable() {
                    public void run() {
                        COMPANY AMUL = COMPANY.createcompany();
                    }
                });
        t1.start();
        try {
            Thread.sleep(100);
        } catch (Exception e) {

        }
        t2.start();
    }
}

class COMPANY {
    static COMPANY obj;

    private COMPANY() {
        System.out.println("COMPANY CREATED SUCESSFULLY");
    }

    public static synchronized COMPANY createcompany() {
        if (obj == null) {
            synchronized (COMPANY.class) {
                if (obj == null) {
                    obj = new COMPANY();
                }
            }
        }
```

```
        return obj;
    }
}
```

Output:

```
PS C:\Users\onlyf\OneDrive\Desktop\PDEU\Sem4\Design Patter
n\Singleton> cd "c:\Users\onlyf\OneDrive\Desktop\PDEU\Sem4
\Design Pattern\Singleton\" ; if ($?) { javac singleton4.j
ava } ; if ($?) { java singleton4 }
COMPANY CREATED SUCESSFULLY
PS C:\Users\onlyf\OneDrive\Desktop\PDEU\Sem4\Design Patter
n\Singleton>
```

Method 5: Just another way to implement Efficiently

Code:

```
public class singleton5 {
    public static void main(String[] args) {
        COMPANY AMUL = COMPANY.INSTANCE;
        COMPANY AMUL2 = COMPANY.INSTANCE;
    }
}

enum COMPANY {
    INSTANCE;

    COMPANY() {
        System.out.println("Object Created");
    }
}
```

Output:

```
PS C:\Users\onlyf\OneDrive\Desktop\PDEU\Sem4\Design Patter
n\Singleton> cd "c:\Users\onlyf\OneDrive\Desktop\PDEU\Sem4
\Design Pattern\Singleton\" ; if ($?) { javac singleton5.j
ava } ; if ($?) { java singleton5 }
Object Created
PS C:\Users\onlyf\OneDrive\Desktop\PDEU\Sem4\Design Patter
n\Singleton>
```