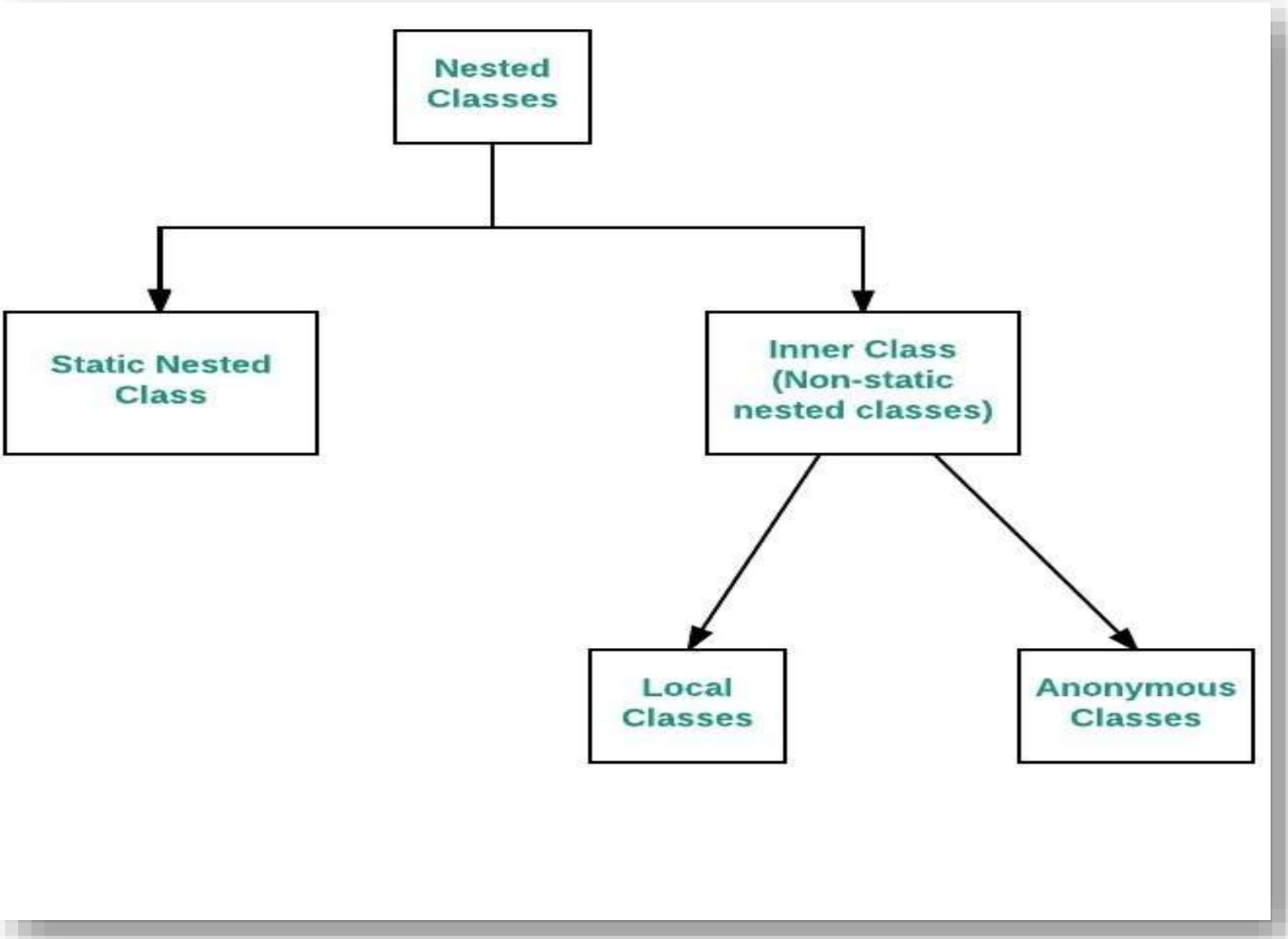
2.10 Nested Classes in Java

- In java, it is possible to define a class within another class, such classes are known as *nested* classes.
- They enable you to logically group classes that are only used in one place, thus this increases the use of encapsulation, and create more readable and maintainable code.



- The scope of a nested class is bounded by the scope of its enclosing class.
- Thus in above example, class *NestedClass* does not exist independently of class *OuterClass*.
- A nested class has access to the members, including private members, of the class in which it is nested.

- However, reverse is not true i.e. the enclosing class does not have access to the members of the nested class.
- A nested class is also a member of its enclosing class.
- As a member of its enclosing class, a nested class can be declared ***private, public, protected,*** **or** ***package private*****(default).**

- Nested classes are divided into two categories:
  1. **static nested class :** Nested classes that are declared *static* are called static nested classes.
  2. **inner class :** An inner class is a non-static nested class.

Syntax:

```
class OuterClass
{
...
    class NestedClass
    {
        ...
    }
}
```

1. Static nested classes:

- As with class methods and variables, a static nested class is associated with its outer class.
- And like static class methods, a static nested class cannot refer directly to instance variables or methods defined in its enclosing class: it can use them only through an object reference.
- They are accessed using the enclosing class name.

```
OuterClass.StaticNestedClass
```

For example, to create an object for the static nested class, use this

syntax:

```
OuterClass.StaticNestedClass nestedObject =
        new OuterClass.StaticNestedClass();
```

```
// Java program to demonstrate accessing
// a static nested class
// outer class
class OuterClass
{
    // static member
    static int outer_x = 10;

    // instance(non-static) member
    int outer_y = 20;

    // private member
    private static int outer_private = 30;
        // static nested class
    static class StaticNestedClass
    {
        void display()
        {
            // can access static member of outer class
            System.out.println("outer_x = " + outer_x);

            // can access display private static member of outer class
            System.out.println("outer_private = " + outer_private);

            // The following statement will give compilation error
            // as static nested class cannot directly access non-static
member
            // System.out.println("outer_y = " + outer_y);

        }
    }
```

```
}

// Driver class
public class StaticNestedClassDemo
{
    public static void main(String[] args)
    {
        // accessing a static nested class
        OuterClass.StaticNestedClass nestedObject = new
OuterClass.StaticNestedClass();
                nestedObject.display();
    }
}
```

Output:

```
outer_x = 10
outer_private = 30
```

2. Inner classes:

- To instantiate an inner class, you must first instantiate the outer class. Then, create the inner object within the outer object with this
- **syntax:**

```
OuterClass.InnerClass innerObject = outerObject.new InnerClass();
```

There are two special kinds of inner classes:

1. Local inner classes
2. Anonymous inner classes

```
// Java program to demonstrate accessing
// a inner class
 // outer class
class OuterClass
{
```

```
    // static member
    static int outer_x = 10;

    // instance(non-static) member
    int outer_y = 20;

    // private member
    private int outer_private = 30;

    // inner class
    class InnerClass
    {
        void display()
        {
            // can access static member of outer class
            System.out.println("outer_x = " + outer_x);

            // can also access non-static member of outer class
            System.out.println("outer_y = " + outer_y);

            // can also access private member of outer class
            System.out.println("outer_private = "+outer_private);

        }
    }
}

// Driver class
public class InnerClassDemo
{
    public static void main(String[] args)
    {
        // accessing an inner class
        OuterClass outerObject = new OuterClass();
```

```
OuterClass.InnerClass innerObject = outerObject.new InnerClass();
        innerObject.display();

    }
}
```

Output:

```
outer_x = 10
outer_y = 20
outer_private = 30
```

- **Difference between static and inner(non-static nested) classes**
  - Static nested classes do not directly have access to other members (non-static variables and methods) of the enclosing class because as it is static, it must access the non-static members of its enclosing class through an object.
  - That is, it cannot refer to non-static members of its enclosing class directly.
  - Because of this restriction, static nested classes are seldom used.
  - Non-static nested classes (inner classes) has access to all members (static and non-static variables and methods, including private) of its outer class and may refer to them directly in the same way that other non-static members of the outer class do.