Object-Oriented Programming Concepts

Session: 4

Abstraction and Inheritance

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Objectives

- Define Abstraction
- Explain Levels of Abstraction
- Define Inheritance
- Explain Types of Inheritance
- Explain Variants in Inheritance
- List the Advantages of Inheritance

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Abstraction 1-3

Deliberate omission of some aspects of an object or process

To bring more clarity to other aspects or details of that object

Purposeful suppression of details about an object is also called Information hiding

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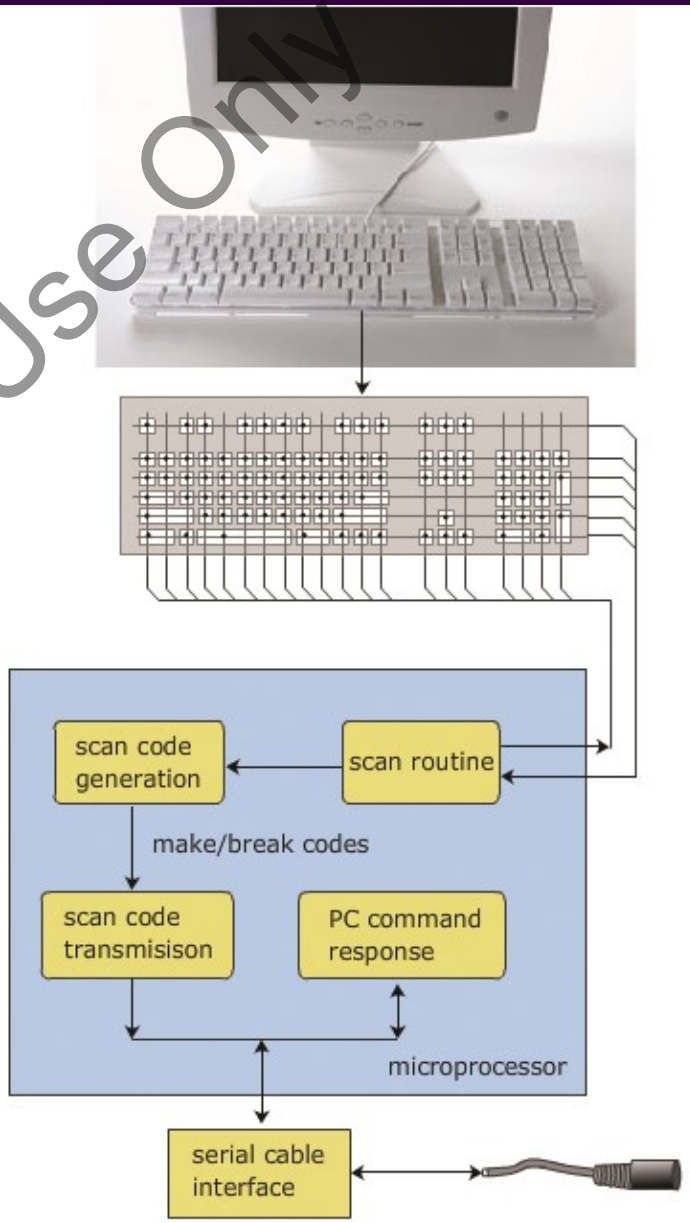
Abstraction 2-3

- The figure shows the abstraction of the complex process of signal transmission by the keyboard



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Abstraction 3-3

- The C# code given in the Code Snippet shows an example of abstraction.

Code Snippet

```
using System;
public class Horse
{
    static void Main()
    {
        Console.WriteLine("This is class
Horse");
    }
}
```

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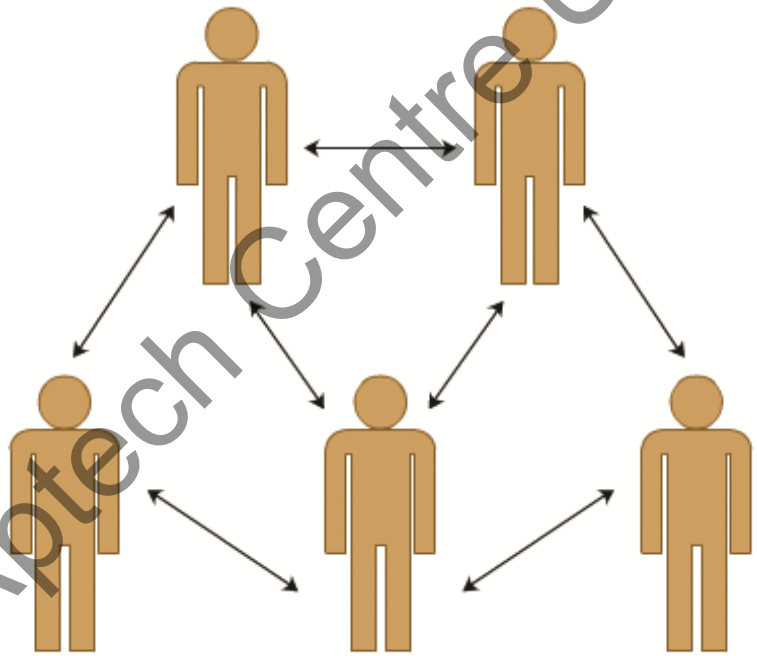
Levels of Abstraction 1-6

Topmost level

A program is viewed as a collection or community of agents or objects interacting with each other to complete a task



- For example, a community of developers, who must interact with each other to develop a software

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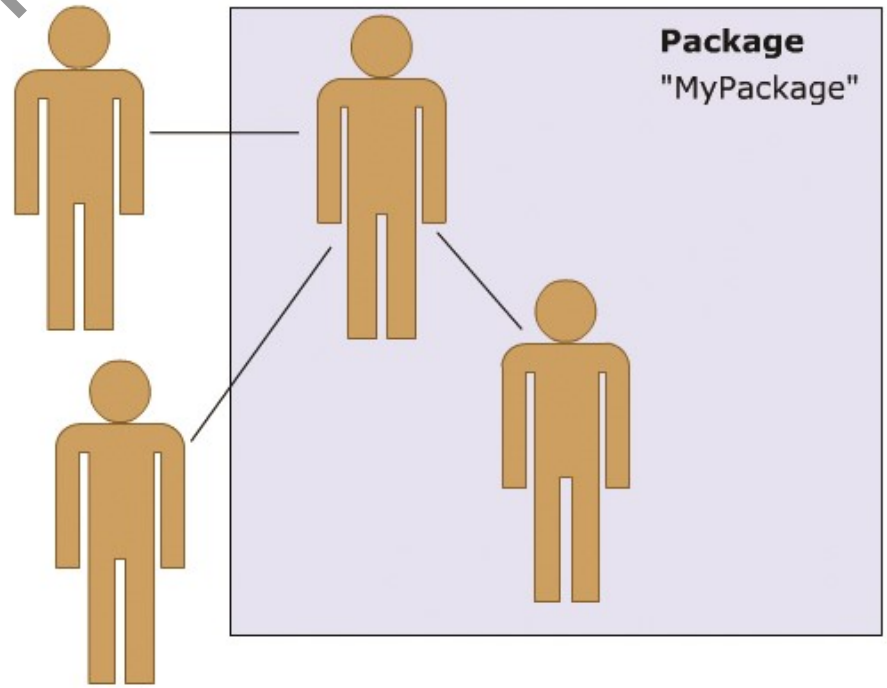
Levels of Abstraction 2-6

Next level

Groups objects working together or having common characteristics into a unit

- The unit allows certain objects to be exposed to the objects outside the unit, while other features remain hidden inside the unit.



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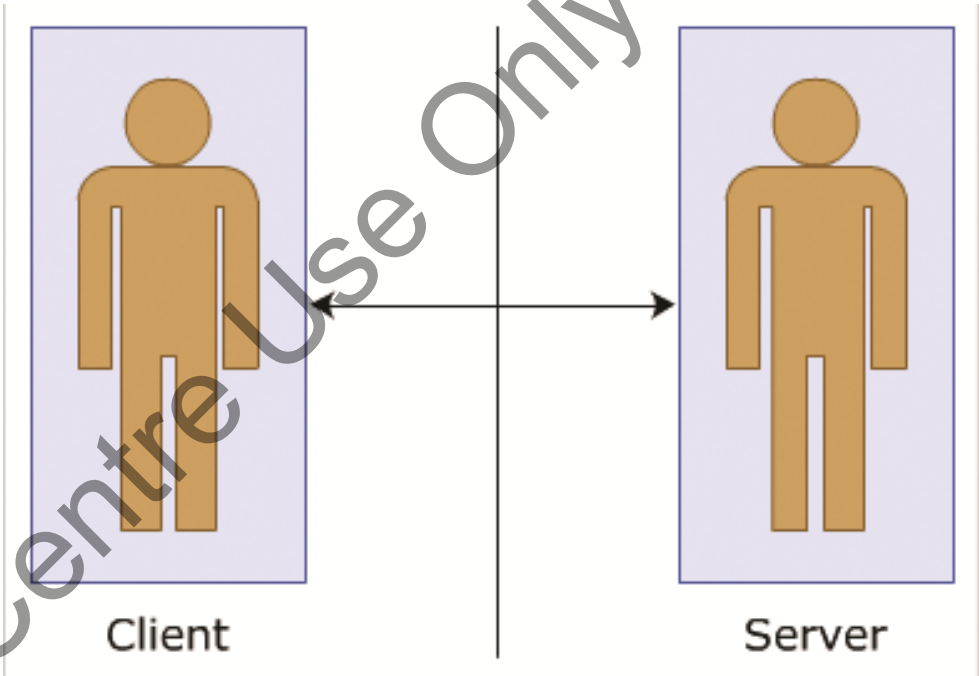
Levels of Abstraction 3-6

- An object often provides services to other objects. Such an object is called a server and the object receiving the service is called the client.



Next level

Interactions between two objects

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Levels of Abstraction 4-6

- This level is concerned with the exact sequence of operations to be done to perform one task

Last level

A single task or method in isolation

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Levels of Abstraction 5-6

- For example, details of operations to be done to check if a number is even or odd. This is shown in the Code Snippet.

Code Snippet

```
public class CheckNum
{
      public void check(int num)
      {
            if(num % 2 == 0)
               Console.WriteLine("Even");
            else
               Console.WriteLine("Odd");
      }
}
```

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Levels of Abstraction 6-6

- Other forms of Abstraction

Division into parts is called has-a abstraction

Division into specializations is called is-a abstraction

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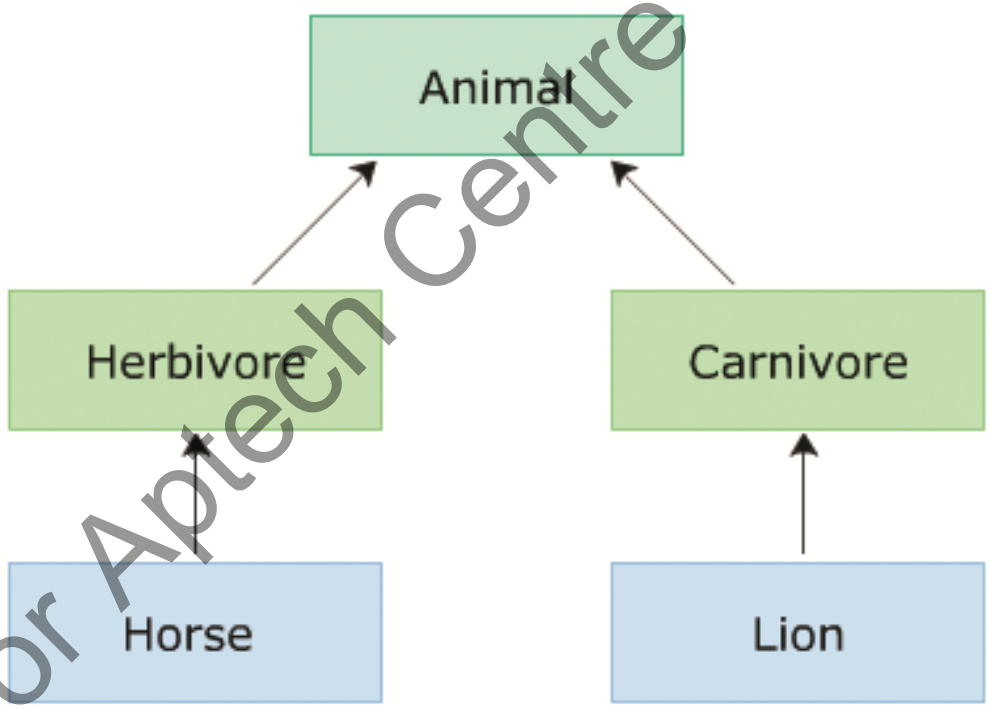
Inheritance

- A technique in object-oriented programming
- Used to extend the functionality of a class by creating a new class



A real world example of inheritance

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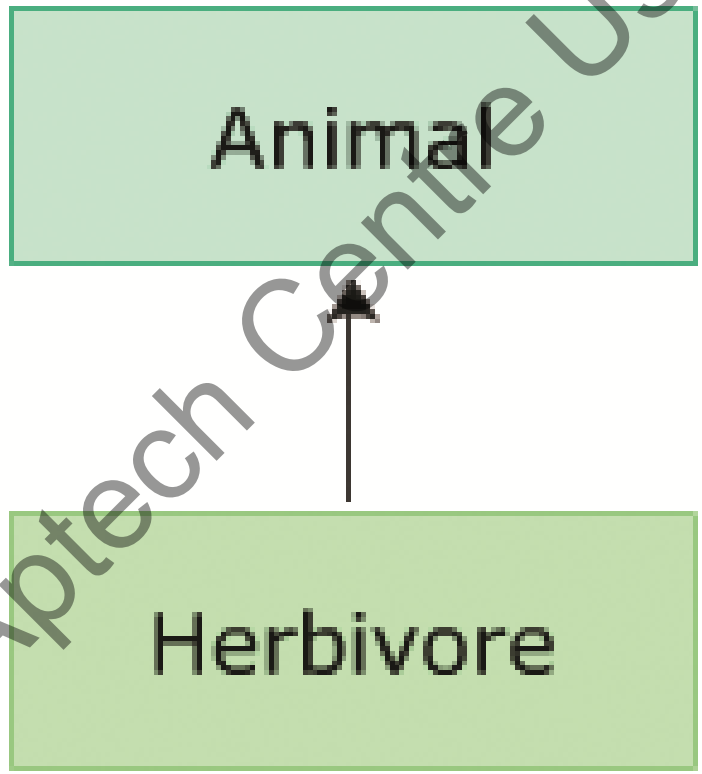
Single Inheritance

- When a class derives from only one base class



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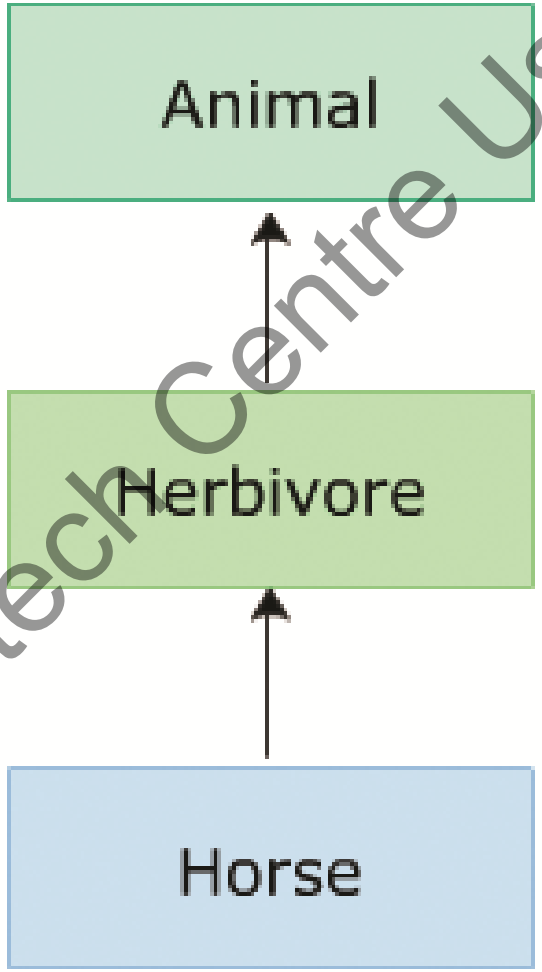
Multilevel Inheritance

- When a class derives from another derived class



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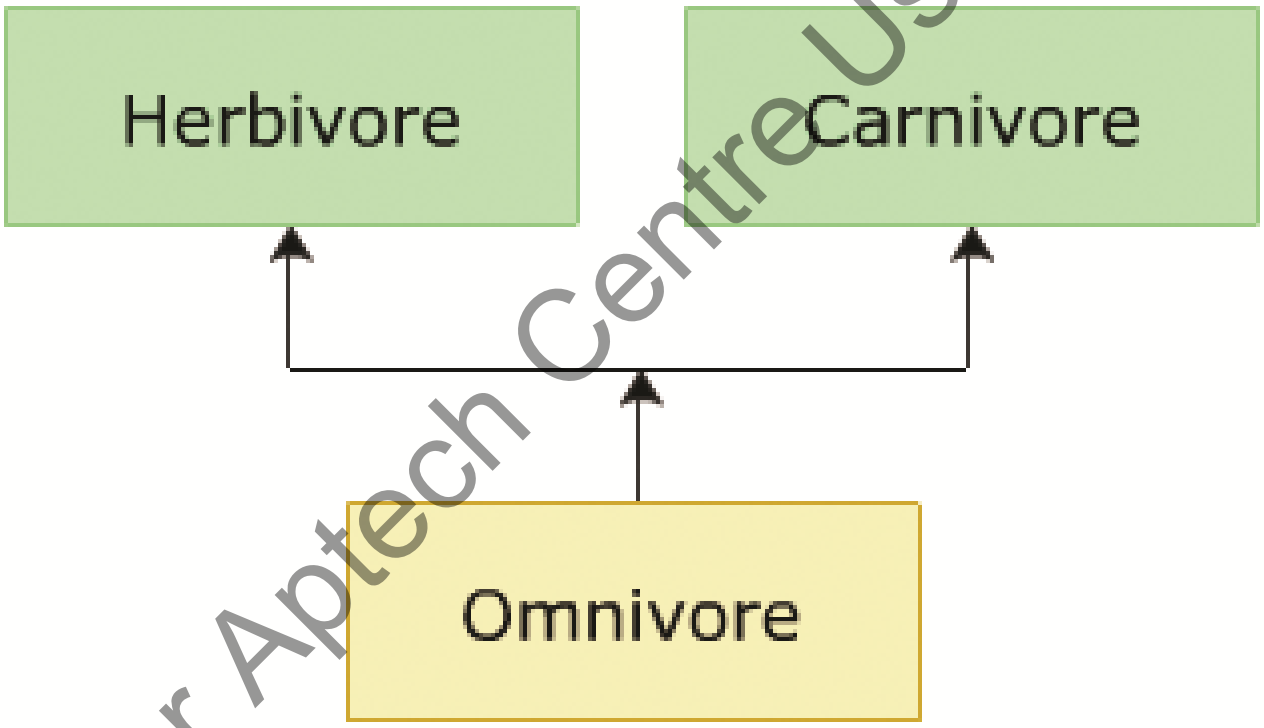
Multiple Inheritance

- When a class derives from more than one base class



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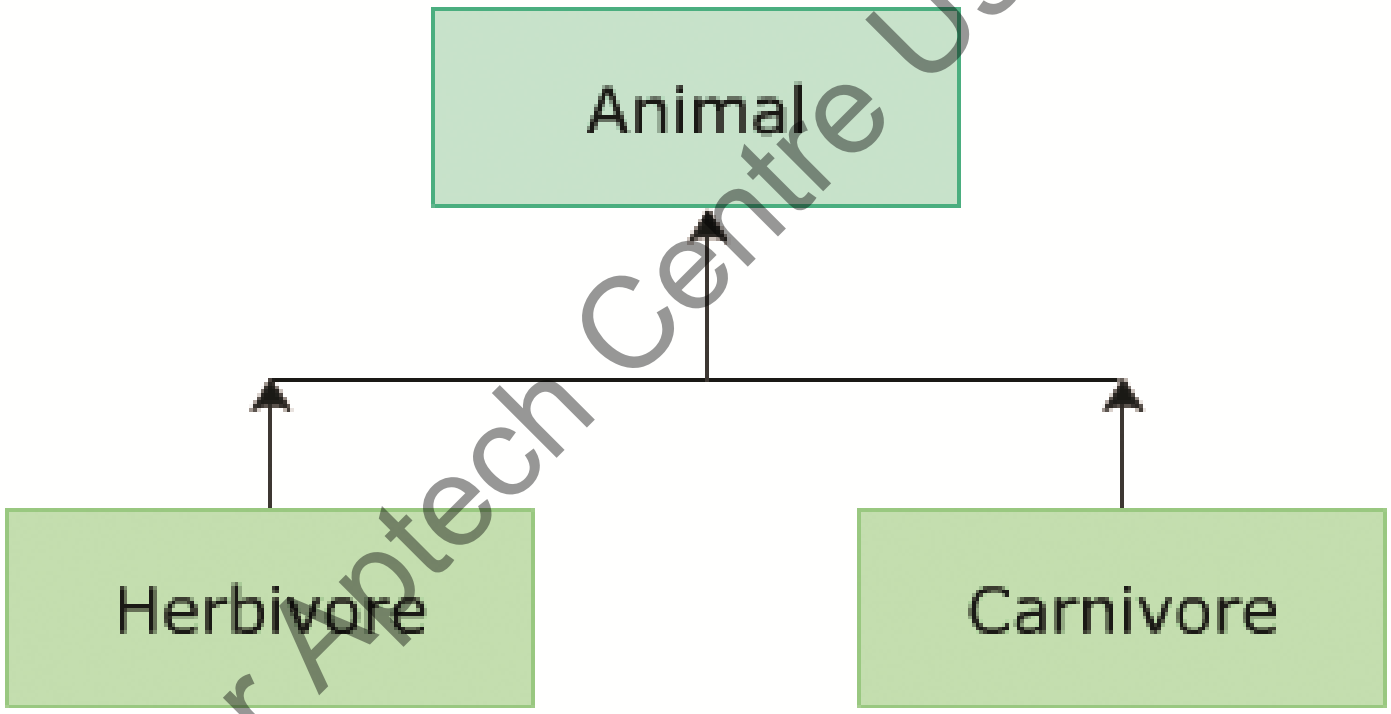
Hierarchical Inheritance

- When more than one child class derives from one base class



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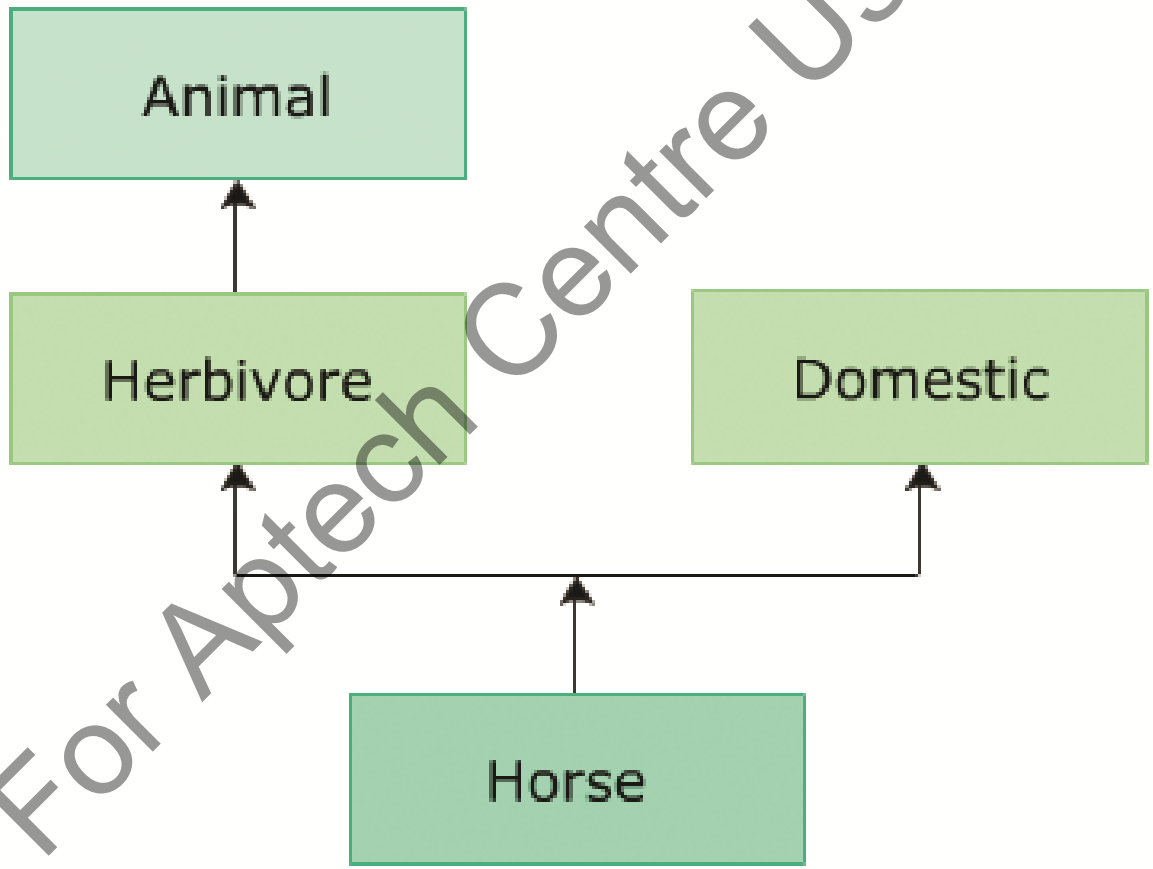
Hybrid Inheritance

- When a class derivation involves more than one form of inheritance



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Variants in Inheritance

- Inheritance can have several implementations. Some of the variants are as follows:

Anonymous class

Constructors and Inheritance

Inner classes

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Anonymous Class

- A class that should have only one instance is called a singleton
- A class is called an anonymous class when it does not have an identity

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Constructors and Inheritance

- A constructor is a method with the same name as the class name and is invoked automatically when a new instance of a class is created

- Constructors of both classes must be executed when the object of child class is created

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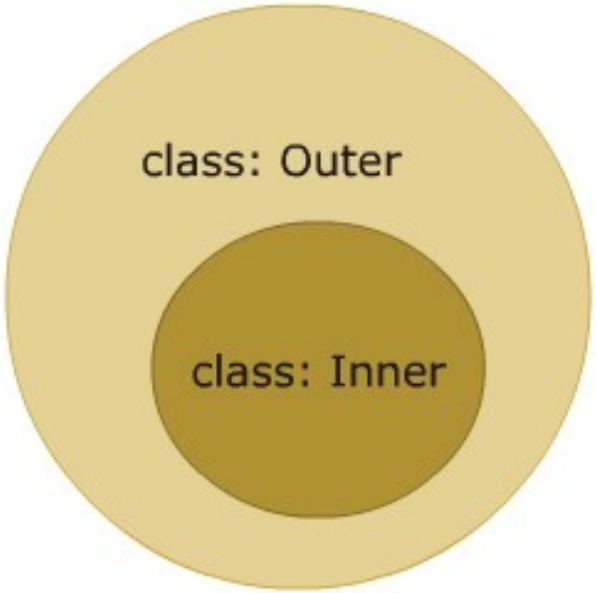
Inner Classes

- Languages such as C++, Java, and C# allow the programmer to create definition of one class inside another class

- Such a class is known as inner class or nested class as shown in the figure



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Advantages of Inheritance

- Some advantages of Inheritance are as follows:

Reusability

Consistency

Modularity

Security

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Summary

- Abstraction is the deliberate omission of some aspects of an object or process in order to bring more clarity to other aspects or details of that object.
- Division into parts is called has-a abstraction as it shows container-content or part-of relation between the objects.
- Division into specialization is called is-a abstraction as it shows type-of or kind-of relation between the objects.
- Inheritance is a technique in object-oriented programming in which a user can extend the functionality of a class by creating a new class.

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