Unit IV | Object Oriented Programming with C++

CHAPTER 13

Introduction to Object Oriented Programming Techniques

Learing Objectives

After learning this chapter, the students will be able to

- Understand the concept of **OOPS**
- Know the difference between *Procedural*, *Modular* and *Object Oriented Programming*.
- Understand the advantages and disadvantages of Object Oriented Programming.

13.1 Introduction

Object-Oriented Programming (OOP) is the term used to describe a programming approach based on classes and objects. The object-oriented paradigm allows us to organize software as a collection of objects that consist of both data and behaviour. This is in contrast to conventional functional programming practice, that loosely connects data and behaviour.

Since 1980's the word **'object'** has appeared in relation to programming languages, with almost all languages developed since 1990 having object-oriented features. This chapter introduces general OOP concepts.

13.2 Programming Paradigms

Paradigm means organizing principle of a program. It is an approach to programming. There are different approaches available for problem solving using computer. They are Procedural programming, Modular Programming and Object Oriented Programming

13.2.1 Procedural programming

Procedural means a list of instructions were given to the computer to do something. Procedural programming aims more at procedures. This emphasis on doing things.

Important features of procedural programming

- Programs are organized in the form of subroutines or sub programs
- All data items are global
- Suitable for small sized software application
- Difficult to maintain and enhance the program code as any change in data type needs to be propagated to all subroutines that use the same data type. This is time consuming.
- Example: **FORTRAN** and **COBOL**.

13.2.2 Modular programming:-

Modular programming consist of a list of instructions that instructs the computer to do something. But this **Paradigm consists of multiple modules, each module has a set of functions of related types. Data is hidden under the modules.** Arrangement of data can be changed only by modifying the module

Important features of Modular programming

- Emphasis on algorithm rather than data
- Programs are divided into individual modules
- Each modules are independent of each other and have their own local data
- Modules can work with its own data as well as with the data passed to it.
- Example: **Pascal** and **C**

13.2.3 Object Oriented Programming:-

Object Oriented Programming paradigm emphasizes on the data rather than the algorithm. It implements programs using **classes** and **objects.**

Class: A Class is a construct in C++ which is used to bind data and its associated function together into a single unit using the encapsulation concept. Class is a user defined data type. Class represents a group of similar objects.

It can also be defined as a template or blueprint representing a group objects that share common properties and relationship.

Objects: Represents data and its associated function together into a single unit. Objects are the basic unit of OOP. Basically an object is created from a class. They are instances of class also called as class variables

An identifiable entity with some characteristics and behaviour is called object.

Important features of Object oriented programming

- Emphasizes on data rather than algorithm
- Data abstraction is introduced in addition to procedural abstraction
- Data and its associated operations are grouped in to single unit
- Programs are designed around the data being operated
- Relationships can be created between similar, yet distinct data types
- Example: **C++, Java, VB.Net, Python etc.**

13.3 Basic Concepts of OOP

The Object Oriented Programing has been developed to overcome the drawbacks of procedural and modular programming. It is widely accepted that object-oriented programming is the most important and powerful way of creating software.

The Object-Oriented Programming approach mainly encourages:

- **Modularisation:** where the program can be decomposed into **modules**.
- **Software re-use:** where a program can be composed from existing and new modules.

Main Features of Object Oriented Programming

- Data Abstraction
- Encapsulation

- Modularity
- Inheritance
- Polymorphism

13.3.1 Encapsulation

The mechanism by which the data and functions are bound together into a single unit is known as **Encapsulation.** It implements abstraction.

Encapsulation is about binding the data variables and functions together in class. It can also be called **data binding.**

Encapsulation is the most striking feature of a class. The data is not accessible to the outside world, and only those functions which are wrapped in the class can access it. These functions provide the interface between the object's data and the program. **This encapsulation of data from direct access by the program is called data hiding or information hiding.**

13.3.2 Data Abstraction

Abstraction refers to showing only the essential features without revealing background details. Classes use the concept of abstraction to define a list of abstract attributes and function which operate on these attributes. They encapsulate all the essential properties of the object that are to be created. The attributes are called **data members** because they hold information. The functions that operate on these data are called **methods or member function.**

13.3.3 Modularity

Modularity is designing a system that is divided into a set of functional units (named modules) that can be composed into a larger application.

13.3.4 Inheritance

Inheritance is the technique of building new classes **(derived class)** from an existing Class **(base class)**. The most important advantage of inheritance is **code reusability.**

13.3.5 Polymorphism

Polymorphism is the ability of a message or function to be displayed in more than one form.

13.4 Advantages of OOP

Re-usability:

"Write once and use it multiple times" you can achieve this by using class.

Redundancy:

Inheritance is the good feature for data redundancy. If you need a same functionality in multiple class you can write a common class for the same functionality and inherit that class to sub class.

Easy Maintenance:

It is easy to maintain and modify existing code as new objects can be created with small differences to existing ones.

Security:

Using data hiding and abstraction only necessary data will be provided thus maintains the security of data.

13.5 Disadvantages of OOP

Size:

Object Oriented Programs are much larger than other programs.

Effort:

Object Oriented Programs require a lot of work to create.

Speed:

Object Oriented Programs are slower than other programs, because of their size.

Points to Remember:

- Paradigm means organizing principle of a program.It is an approach to programming.
- Procedural or Modular programming means a list of instructions were given and each instructions tell the computer to do something.
- Procedural programming aims more about procedures. In this Programs are organized in the form of subroutines or sub programs
- Modular programming combines related procedures in a module and hides data under modules.
- Object Oriented programming Paradigm emphasizes on the data rather than the algorithm. It implements programs using classes and objects
- Class is a user defined data type. Class represents a group of similar objects.
- Objects are the basic unit of OOP.It represents data and associated function together in to a single unit.
- The mechanism by which the data and functions are bound together into a single unit is known as ENCAPSULATION. It implements abstraction .
- Abstraction refers to showing only the essential features without revealing background details
- Modularity is designing a system that is divided into a set of functional units that can be composed into a larger application.
- Polymorphism is the ability of a message or function to be displayed in more than one form.
- Inheritance is the technique of building new classes (derived class) from an existing class. The most important advantage of inheritance is code reusability.Inheritance is transitive in nature.

Evaluation

SECTION – A

Choose the correct answer

1. The term is used to describe a programming approach based on classes and objects is
   (A) OOP (B) POP (C) ADT (D) SOP

2. The paradigm which aims more at procedures.
   (A) Object Oriented Programming (B)Procedural programming
   (C) Modular programming (D)Structural programming

3. Which of the following is a user defined data type?
   (A) class (B) float (C) int (D) object

4. The identifiable entity with some characteristics and behaviour is.
   (A) class (B) object (C) structure (D) member

5. The mechanism by which the data and functions are bound together into a single unit is known as
   (A) Inheritance (B) Encapsulation
   (C) Polymorphism (D) Abstraction

6. Insulation of the data from direct access by the program is called as
   (A) Data hiding (B) Encapsulation
   (C) Polymorphism (D) Abstraction