# Experiment 04- Implement Class Diagram

**Learning Objective:** To implement UML class diagram for the project.

**Tools:** MS Word, draw.io or any other UML tool.

**Theory:**

**Class Diagrams**

Classes are the structural units in object oriented system design approach, so it is essential to know all the relationships that exist between the classes, in a system. All objects in a system are also interacting to each other by means of passing messages from one object to another.

**Elements in class diagram**

Class diagram contains the system classes with its data members, operations and relationships between classes.

**Class**

A set of objects containing similar data members and member functions is described by a class.
In UML syntax, class is identified by solid outline rectangle with three compartments which contain

**● Class name**

A class is uniquely identified in a system by its name. It lies in the first compartment in class rectangle.

**● Attributes**

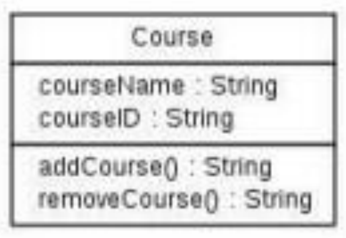
Property shared by all instances of a class. It lies in the second compartment in class rectangle.

**● Operations**

An execution of an action can be performed for any object of a class. It lies in the last compartment in class rectangle.

**Example**

To build a structural model for an Educational Organization, 'Course' can be treated as a class which contains attributes 'courseName' & 'courseID' with the operations 'addCourse()' & 'removeCourse()' allowed to be performed for any object to that class.



● **Generalization/Specialization**

It describes how one class is derived from another class. Derived class inherits the properties of its parent class.

**Example**

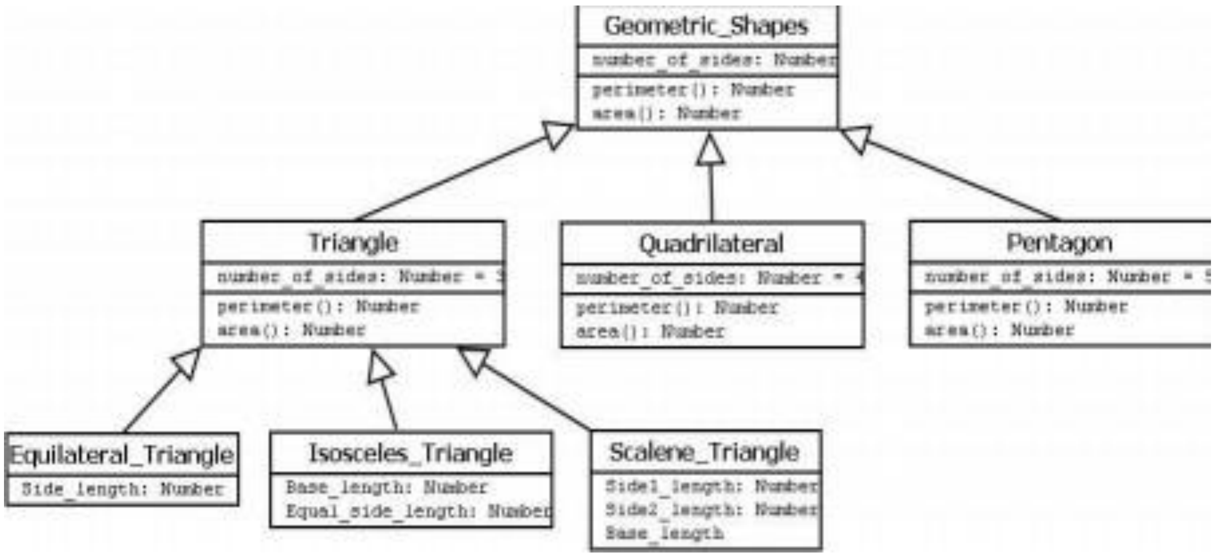


Figure-02:

Geometric Shapes is the class that describes how many sides a particular shape has. Triangle, Quadrilateral and Pentagon are the classes that inherit the property of the Geometric Shapes class. So the relations among these classes are generalization. Now Equilateral Triangle, Isosceles Triangle and Scalene Triangle, all these three classes inherit the properties of Triangle class as each one of them has three sides. So, these are specialization of Triangle class.

**Relationships**

Existing relationships in a system describe legitimate connections between the classes in that system.

● **Association**

It is an instance level relationship that allows exchanging messages among the objects of both ends of association. A simple straight line connecting two class boxes represent an association. We can give a name to association and also at the both end we may indicate role names and multiplicity of the adjacent classes. Association may be uni-directional.

**Example**

In structure model for a system of an organization an employee (instance of ‘Employee’ class) is always assigned to a particular department (instance of ‘Department’ class) and the association can be shown by a line connecting the respective classes.

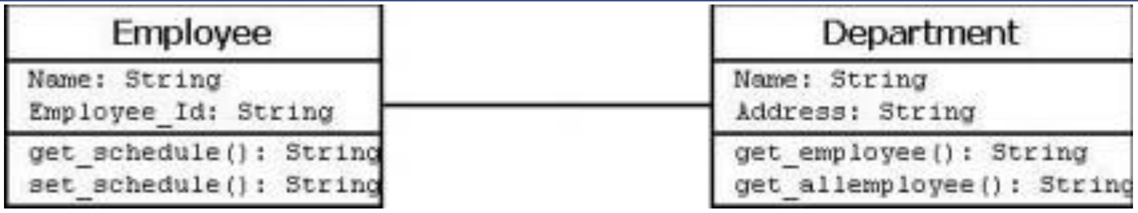


Figure-03:

● **Aggregation**

It is a special form of association which describes a part-whole relationship between a pair of classes. It means, in a relationship, when a class holds some instances of related class, then that relationship can be designed as an aggregation.

**Example**

For a supermarket in a city, each branch runs some of the departments they have. So, the relation among the classes 'Branch' and 'Department' can be designed as aggregation. In UML, it can be shown as in the fig. below.

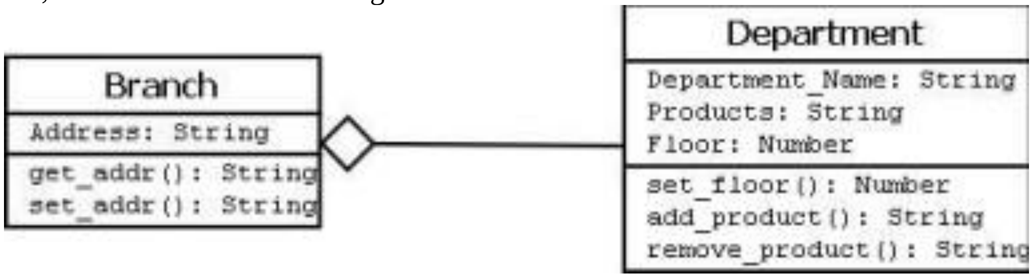


Figure-04:

● **Composition**

It is a strong from of aggregation which describes that whole is completely owns its part. Life cycle of the part depends on the whole.

**Example**
Let consider a shopping mall has several branches in different locations in a city. The existence of branches completely depends on the shopping mall as if it is not exist any branch of it will no longer exists in the city. This relation can be described as composition and can be shown as below

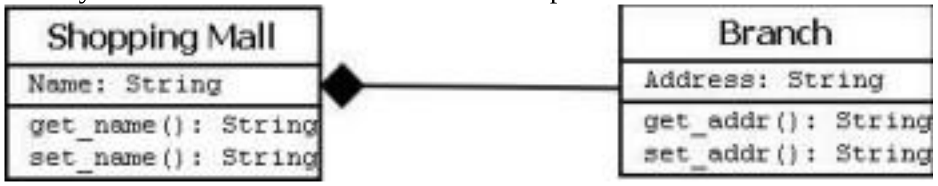
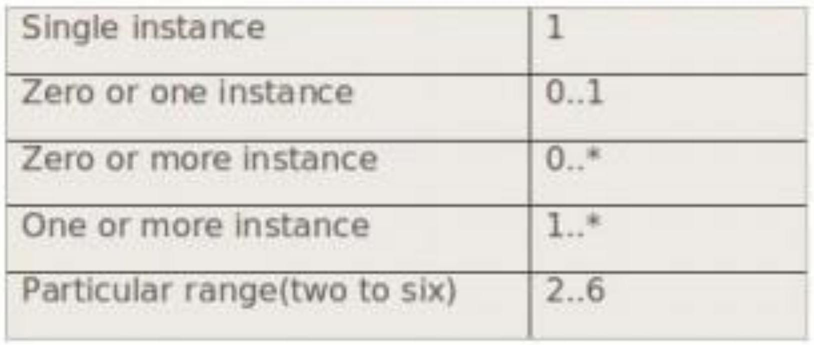


Figure-05:

● **Multiplicity**

It describes how many numbers of instances of one class is related to the number of instances of another class in an association.

**Notation for different types of multiplicity:**



| | |
|---|---|
| Single instance | 1 |
| Zero or one instance | 0..1 |
| Zero or more instance | 0..* |
| One or more instance | 1..* |
| Particular range(two to six) | 2..6 |

Figure-06:

**Example**

One vehicle may have two or more wheels

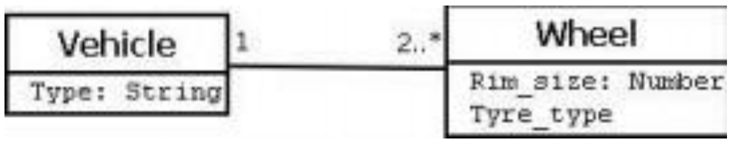


Figure-07:

**Procedure:**
When required to describe the static view of a system or its functionalities, we would be required to draw a class diagram. Here are the steps you need to follow to create a class diagram.

*Step 1: Identify the class names*

The first step is to identify the primary objects of the system.

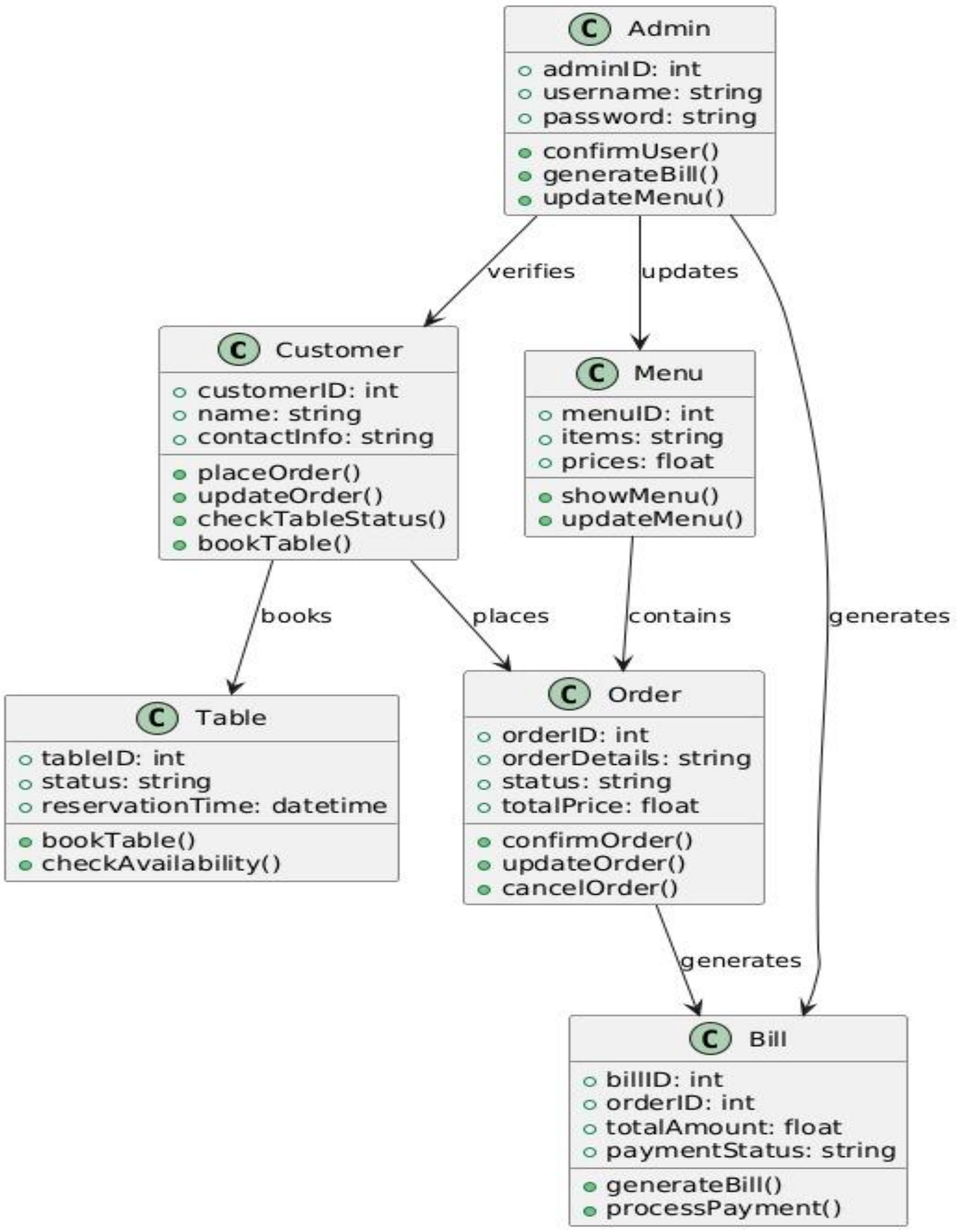
*Step 2: Distinguish relationships*

Next step is to determine how each of the classes or objects are related to one another. Look out for commonalities and abstractions among them; this will help you when grouping them when drawing the class diagram.

*Step 3: Create the Structure*

First, add the class names and link them with the appropriate connectors. You can add attributes and functions/ methods/ operations later.

**<u>Result and Discussion:</u>**



- Admin
  - Attributes: `adminID`, `username`, `password`
  - Methods: `confirmUser()`, `generateBill()`, `updateMenu()`
  - Role: Verifies customers, updates menu, and generates bills.
- Customer
  - Attributes: `customerID`, `name`, `contactInfo`
  - Methods: `placeOrder()`, `updateOrder()`, `checkTableStatus()`, `bookTable()`
  - Role: Can place and update orders, check table availability, and book tables.

- Table
  - Attributes: `tableID`, `status`, `reservationTime`
  - Methods: `bookTable()`, `checkAvailability()`
  - Role: Manages table reservations and availability.
- Menu
  - Attributes: `menuID`, `items`, `prices`
  - Methods: `showMenu()`, `updateMenu()`
  - Role: Stores food items and prices, which the admin updates.
- Order
  - Attributes: `orderID`, `orderDetails`, `status`, `totalPrice`
  - Methods: `confirmOrder()`, `updateOrder()`, `cancelOrder()`
  - Role: Contains order details, status, and total price, linking to menus and bills.
- Bill
  - Attributes: `billID`, `orderID`, `totalAmount`, `paymentStatus`
  - Methods: `generateBill()`, `processPayment()`
  - Role: Generates bills for orders and tracks payment status.

**Learning Outcomes:**

LO 1: Identify the importance of class diagrams.

LO 2: Draw class diagrams for a given scenario.

**Course Outcomes:** Upon completion of the course students will be able to understand and demonstrate class diagrams.

**Conclusion:**

For Faculty Use:

| **Correction Parameters** | **Formative Assessment [40%]** | **Timely completion of Practical [ 40%]** | **Attendance / Learning Attitude [20%]** | |
|---|---|---|---|---|
| **Marks Obtained** | | | | |