JAYPEE INSTITUTE OF INFORMATION TECHNOLOGY–NOIDA
CI311- Object-Oriented Programming
Tutorial / LAB – Week 4

Question 1. Composition gives a 'part-of' relationship. Composition is shown on a UML diagram as a filled diamond (see Figure 1). If we were going to model a car, it would make sense to say that an engine is part-of a car. Within composition, the lifetime of the part (Engine) is managed by the whole (Car), in other words, when Car is destroyed, Engine is destroyed along with it.

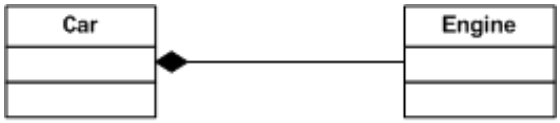


Figure 1 - Composition

Question 2. Aggregation gives a 'has-a' relationship. Within aggregation, the lifetime of the part is not managed by the whole. For Example, the Customer Relationship Management (CRM) system has a database of customers and a separate database that holds all addresses within a geographic area. Aggregation would make sense in this situation, as a Customer 'has-a' Address. It wouldn't make sense to say that an Address is 'part-of' the Customer, because it isn't. Consider it this way, if the customer ceases to exist, the address does not cease to exist. Aggregation is shown on a UML diagram as an unfilled diamond (see Figure 2).

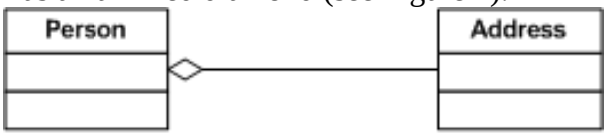
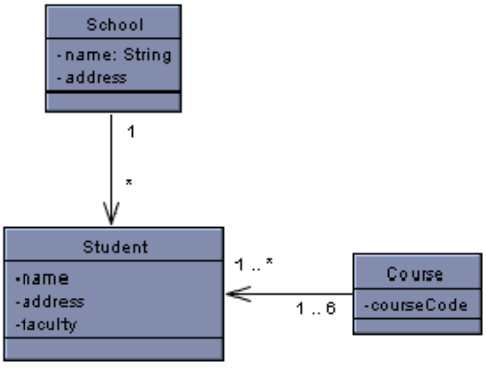


Figure 2 - Aggregation

Question 3. The **association** link indicates that two classes have a relationship: For example: a student attends a school; a student takes courses.



Implement the three types of relationships in C++ as shown in figures given in Question 1, 2 and 3.

Question 4. Design and implement a connection tracking system for a mobile service provider
The System should provide for tracking connections (prepaid only) and calls. The connection consists of 10 digit mobile no., balance and validity. Calls can be of three types LOCAL or ISD or STD. The local call should consist of two local phone nos. each for caller and called, call rate (per 30 sec), call duration. STD call should consists of two mobile nos. each for caller and called , duration, call rate(call rate has two components one is fixed component which charged once when the call is initiated, variable component which is charged for each 30 seconds). ISD calls should have two mobile nos. each for caller and called, country to which call is made, call rate which is different for different countries, and call duration.
There are two users of the system 1) Manager 2) Employee. So the system has to provide two user interfaces.
A. The manager is provided with the following services

1. Change the rate of calls (only for STD and LOCAL).
2. View sales report showing total revenue earned from STD call, Local Calls and ISD calls.

B. The employee is provided with following options

1. Make new connection.
2. Recharge a connection.
3. Create calls and update balance of connection objects for caller only in all cases(input no of calls (no of call objects to be created), use random number function to generate call objects randomly by generating random nos. to choose connection objects/mobile nos., type of call and duration of call.)

You have to provide ISD service for the following Countries.
USA, CANADA, UAE, UK. Assume your own call rates.

Draw the UML class diagram also.

Question 5. Mail messages are important way of communicating messages on the network. These messages are delivered through a Store and Forward mechanism. In this mechanism each message that is to be sent is inserted into a queue and when the network path is free to deliver, the message is deleted from the queue and delivered. Each message has one header that carries the heading of the message and a body that contains the main text. A message can have zero or more attachments. Total attachment size can not exceed 20 Mb in which case an error is generated. At the time when a message is written the header and body is created and on message destruction they are destroyed. The attachment is a link to some external document which is not affected on deletion of message. Reuse your Queue class created before for implementing the 'Store and Forward' mechanism for the mailing system.

a) Identify the attributes and operations for Header, Body, Attachment and Message Class. Identify the relationship types and their implementation strategy. Represent using UML notation
c) Implement the mailing system that also demonstrate and test the order of creation and destruction of objects of each of the four classes-Header, Body, Attachment and Message class.

Question 6. In a hospital it is desired to allot patients to doctors at the time a patient is admitted to either out-patients department or in-patients department. Patients are asked to specify the doctor they wish to consult. A patient can be allotted to exactly one doctor. Patients have an admission number that is given to them at the time of admission. Additionally the last 5 major

ailments and their dates are obtained from the patient. Doctors have identification number. Details of their consultation room no, building and floor is also kept. Doctors are recruited and promoted in the hospital.

Draw a UML class Diagram for the above case.