IT313: Software Engineering
Autumn 2024-25
Lab Session: Class Modeling

Q.1 Prepare a class diagram for the following object diagram that shows a portion of Europe.

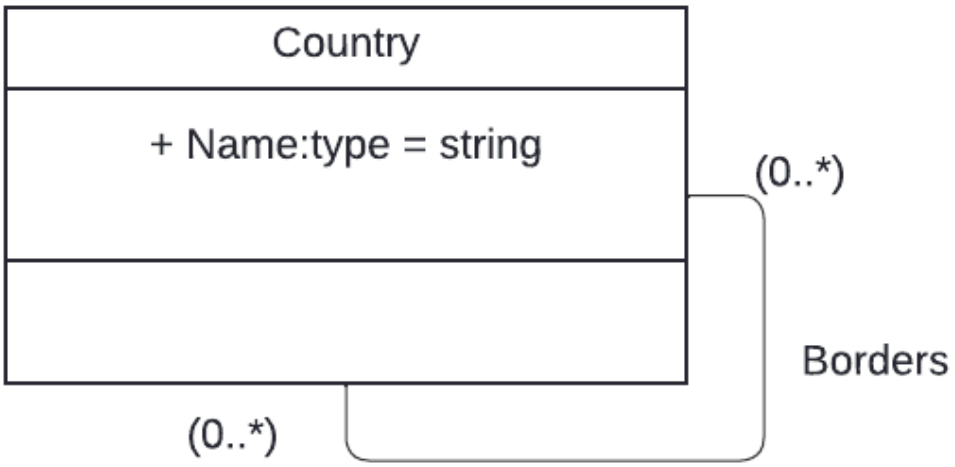
Figure-1

Ans:-

Class Diagram Structure:

Class Name: Country
Attributes: name: String
Associations: Borders : A many-to-many association between the Country class. Diagram Representation

Diagram Representation:



- **Each country (such as Spain, France, Belgium) is an instance of the `Country` class, and the "Borders" relationship represents an association between instances of this class.**

- **This class diagram generalizes the structure shown in your object diagram by abstracting individual countries into a more general "Country" class and the "Borders" relationship.**

Q.2 Prepare a class diagram for object diagram given in Figure -2. Explain your multiplicity decisions. What is the smallest number of points required to construct a polygon? Does it make a difference whether or not point may be shared between polygons? Your answer should address the fact that

points are ordered.

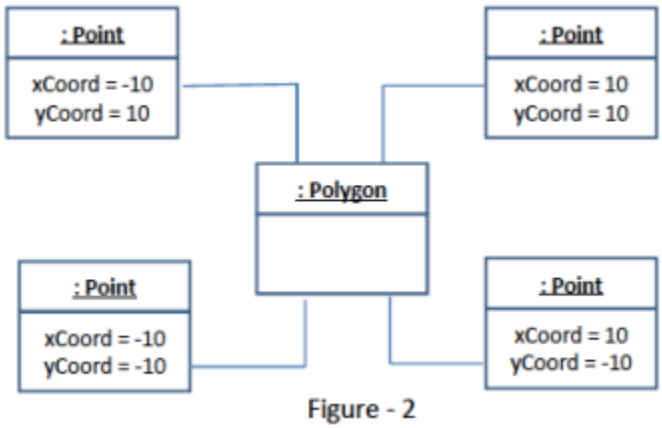


Figure - 2

Ans:-

Classes:

- **Point: Represents coordinates with xCoord and yCoord attributes.**
- **Polygon: Defined by multiple Point objects, as shown in the diagram.**

  Attributes:-

  Point Class:

  - **xCoord: int**
  - **yCoord: int**

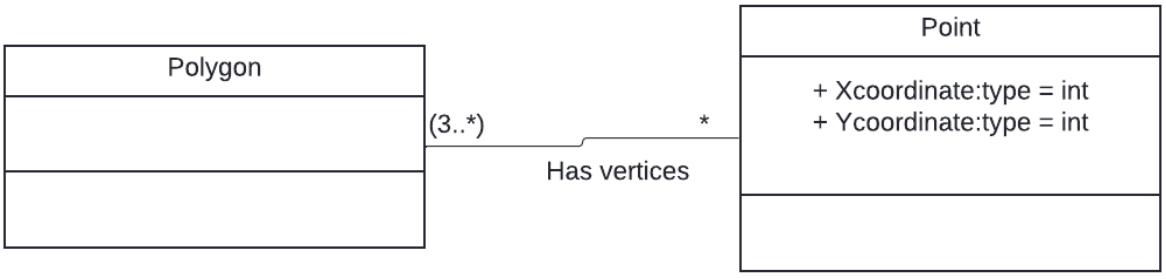
Polygon Class:

- **The Polygon class itself does not seem to have additional attributes based on the diagram.**

Relationships (Associations)

- **Polygon and Point: A polygon has a one-to-many relationship with points, and the points must be ordered to form the shape.**
  Multiplicity: A polygon needs at least 3 points.

- **Shared Points: Points can be shared between polygons, making the relationship many-to-many (multiple polygons can share points).**



Explanation of Multiplicity:

- Polygon to Point:

- **A polygon has at least 3 points (hence 1..* cardinality).**
- **A point can belong to multiple polygons (many-to-many relationship).**

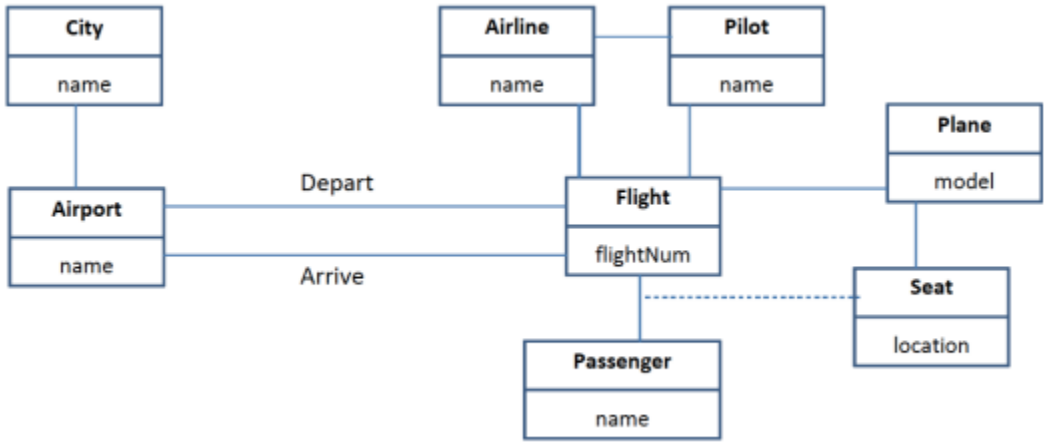
- **Ordered Points:**
  - **The relationship between Polygon and Point is ordered, meaning the order of the points matters when forming the shape.**

- **Smallest Number of Points:**
  - **The smallest number of points required to construct a polygon is 3, as a polygon needs at least three vertices to form a closed shape (a triangle).**

- **Sharing Points Between Polygons:**

- **Yes, points can be shared between polygons (e.g., neighboring polygons on a mesh or grid may share vertices). This does not affect the validity of the polygon, but it may impact the specific shape depending on how points are shared and ordered.**

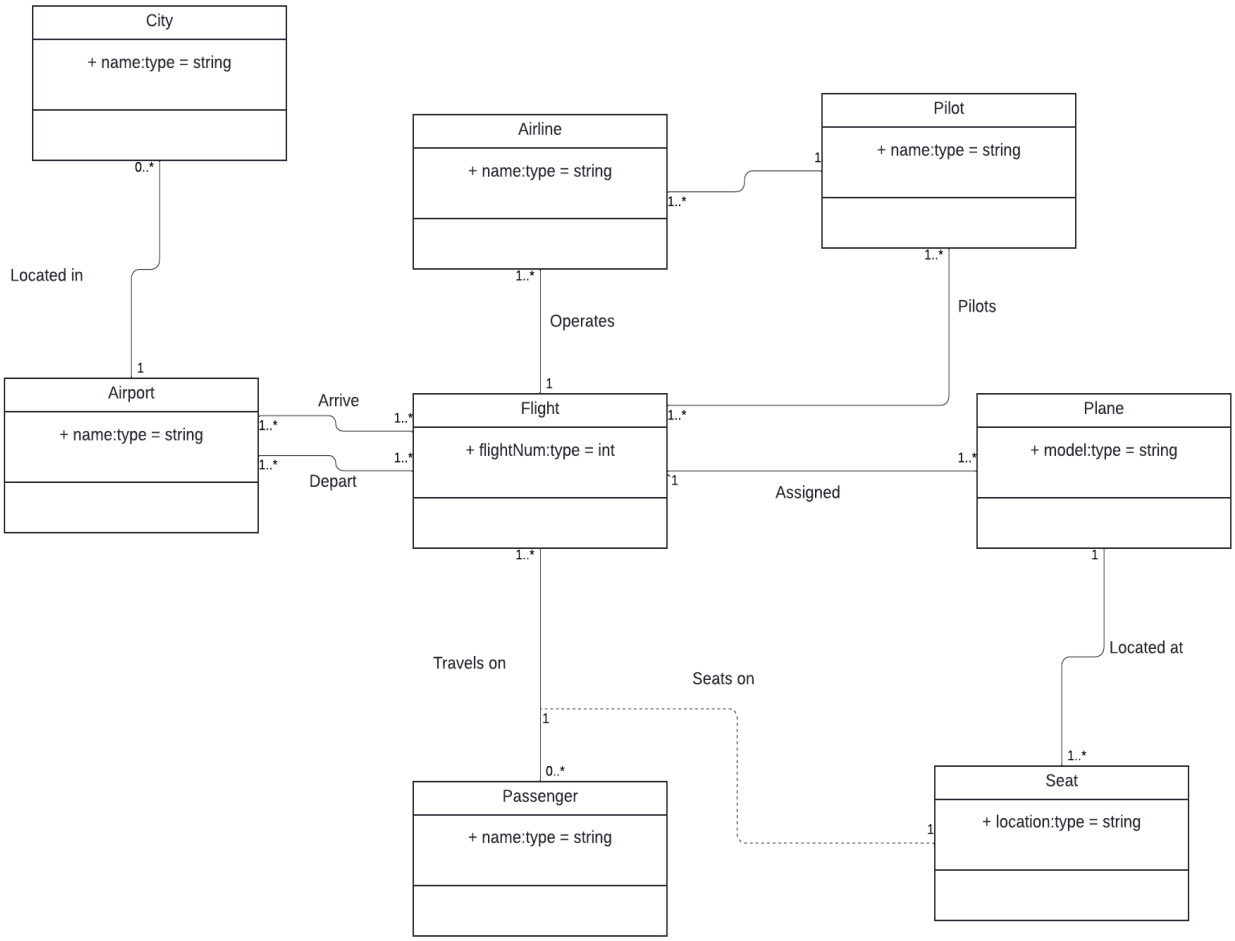
Q.3 Figure 3 is a partially completed class diagram of an air transportation system. Add multiplicities in the diagram. Also add association names to unlevelled associations.



Ans:-

Class Diagram:-

P.T.O



Q.4 We want to model a system for management of flights and pilots. An airline operates flights. Each airline has an ID. Each flight has an ID a departure airport and an arrival airport: an airport as a unique identifier. Each flight has a pilot and a co-pilot, and it uses an aircraft of a certain type; a flight has also a departure time and an arrival time. An airline owns a set of aircrafts of different types. An aircraft can be in a working state or it can be under repair. In a particular moment an aircraft can be landed

or airborne. A company has a set of pilots: each pilot has an experience level: 1 is minimum, 3 is maximum. A type of aeroplane may need a particular number of pilots, with a different role (e.g.: captain, co-pilot, navigator): there must be at least one captain and one co-pilot, and a captain must have a level 3.

Ans:-