

# IT313: Software Engineering

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## Lab Session: Class Modeling

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



### Class Diagram Structure:

**Class Name:** Country

**Attributes:** name: String

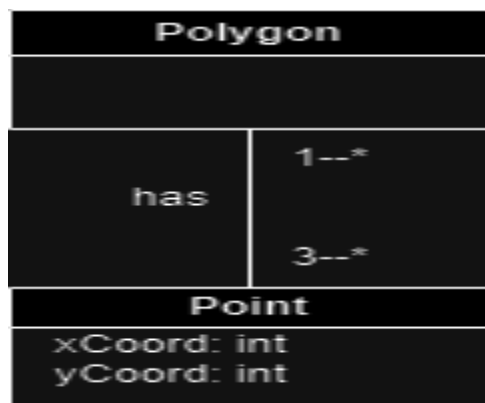
**Associations:** Borders : A many-to-many association between the Country class.

1. Each country (Spain, France, Belgium) is an instance of the Country class, and the "Borders" relation is an association between instances of this class.

2.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.**



## 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:**

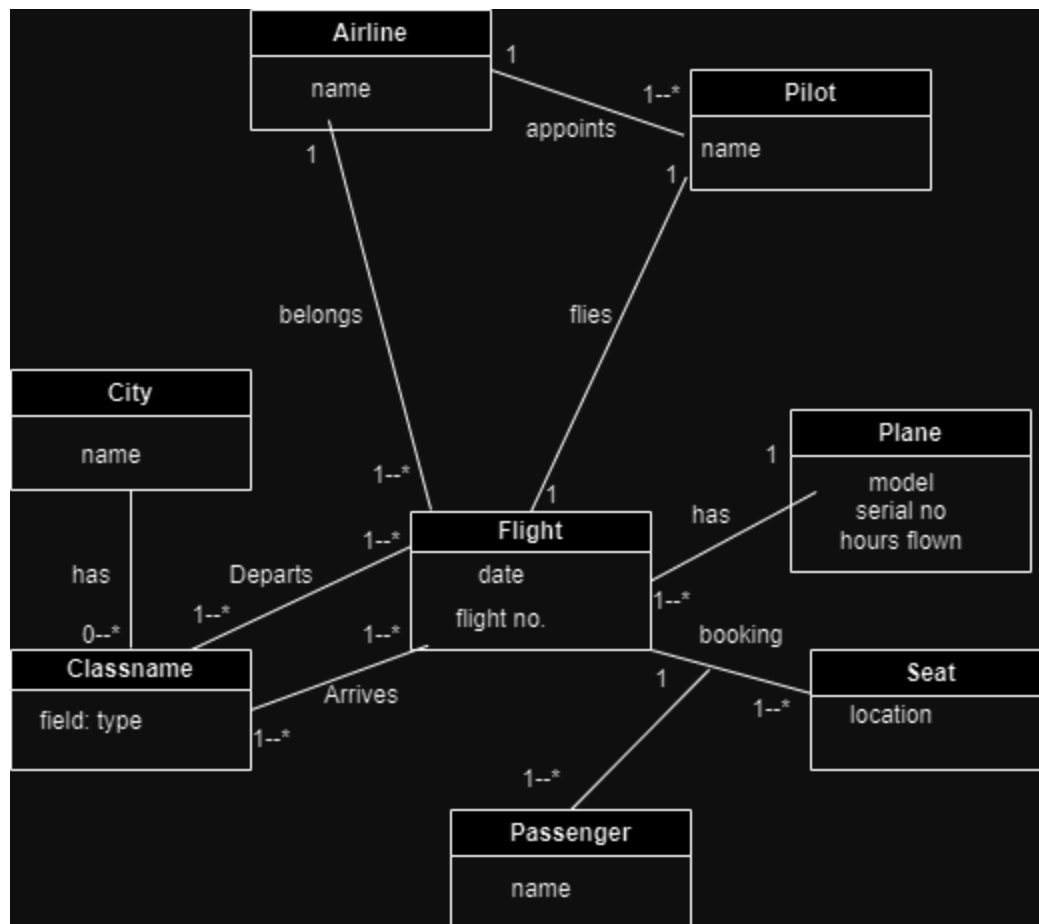
**Polygon to Point:** A polygon has at least 3 points (hence 1..\* cardinality). A point can belong to multiple polygons (many-to-many relationship).

**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.**



**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.

