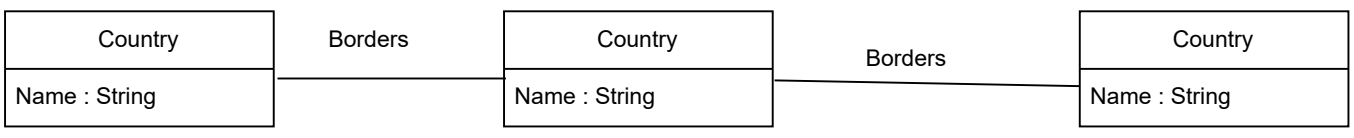
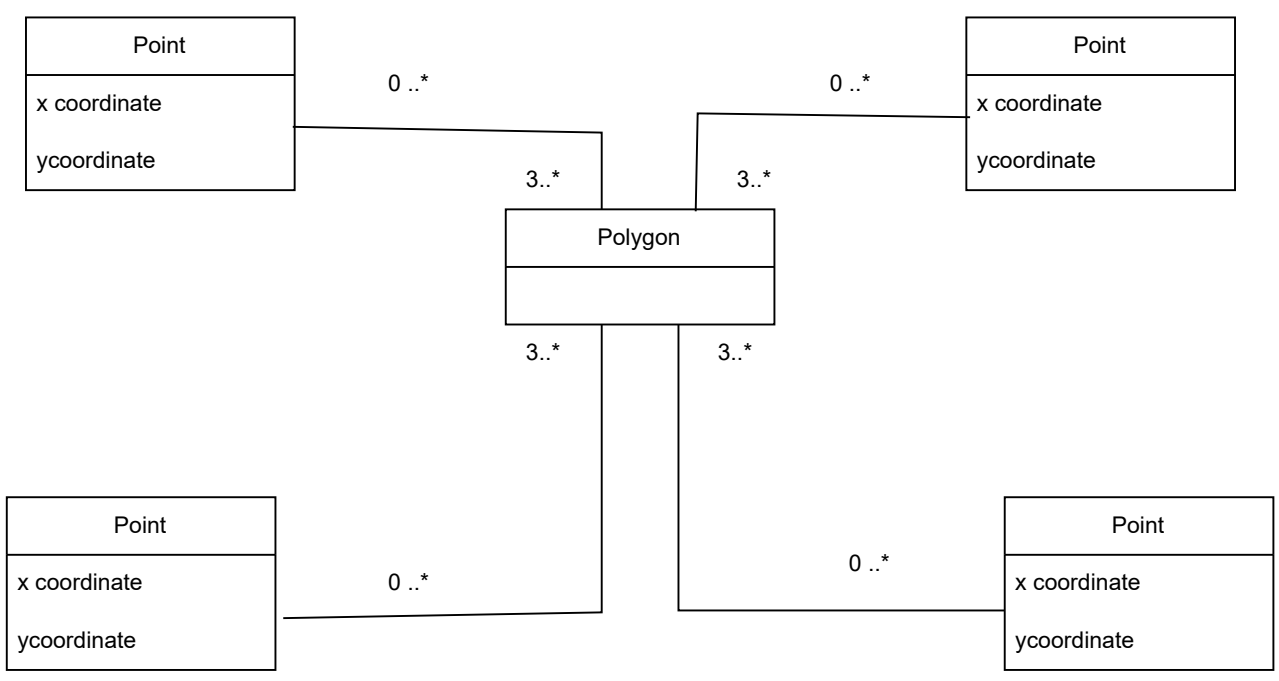
Q.1 Prepare a class diagram for the following object diagram that shows a portion of Europe.



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.



The diagram in Figure 2 shows an object diagram with a `Polygon` object connected to five `Point` objects. Each `Point` object has `xCoord` and `yCoord` attributes, representing their coordinates in a two-dimensional space.

To prepare a class diagram from this object diagram, we should identify the classes and their relationships, including multiplicities.

Class Diagram Explanation:

1. Classes:
- Polygon: Represents a geometric figure composed of multiple points.
- Point: Represents a coordinate in 2D space.

2. Relationships:
- There is an association between the `Polygon` and `Point` classes.
- The association is such that a `Polygon` is made up of multiple `Point` objects.
- The multiplicity of `Point` to `Polygon` is `n..*`, where `n >= 3`, meaning a polygon must have at least three points (the minimum required to form a closed figure).

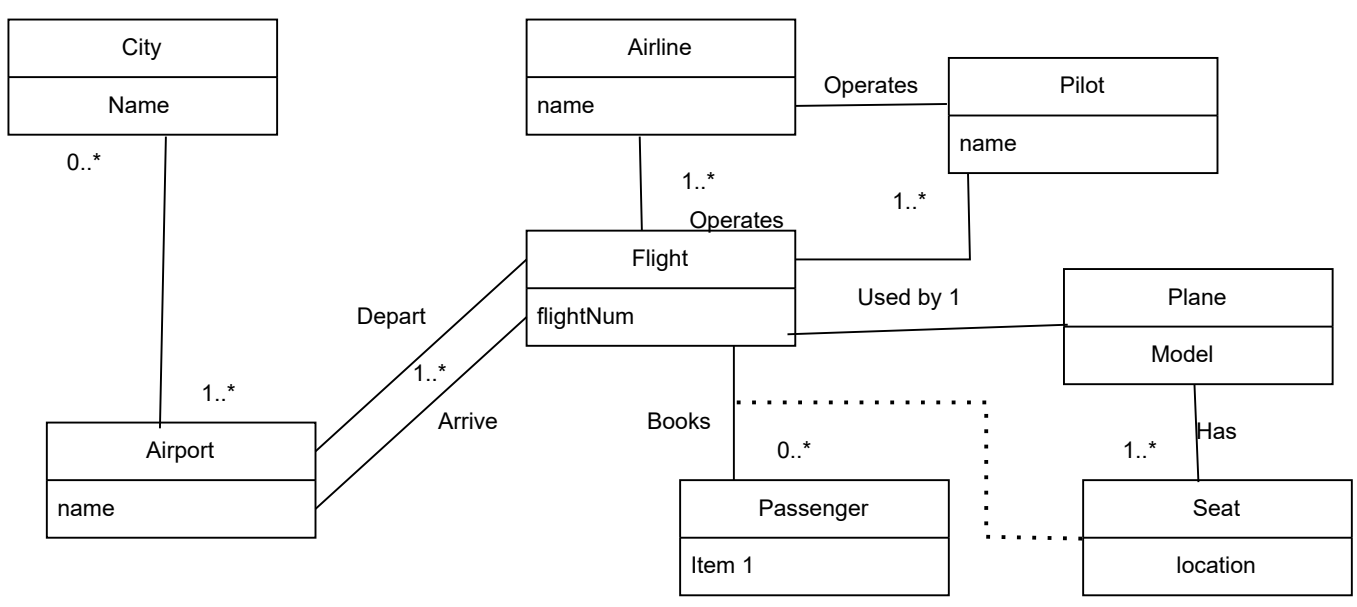
3. Multiplicity Decisions:
- Polygon` to `Point` Multiplicity: A `Polygon` must have at least three `Point` objects (minimum multiplicity of 3) to be considered a valid geometric figure. The upper limit of points is unbounded (`*`).
- Point` to `Polygon` Multiplicity: Each `Point` can belong to zero or more (`0..*`) polygons. This is because points can be shared between different polygons.

4. Smallest Number of Points for a Polygon:
- The smallest number of points required to construct a polygon is 3, as a minimum of three points is necessary to create a closed geometric figure.

5. Impact of Shared Points Between Polygons:
- If points are shared between polygons, then the same `Point` instance can be associated with multiple `Polygon` objects, allowing for complex geometric structures where multiple polygons intersect or overlap.
- The ordering of points is essential in determining the shape and orientation of the polygon. If points are shared, the specific sequence of points in each polygon determines its unique shape.

- Polygon
- Association with `Point`: `3..*`
- Point
- Association with `Polygon`: `0..*`

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.