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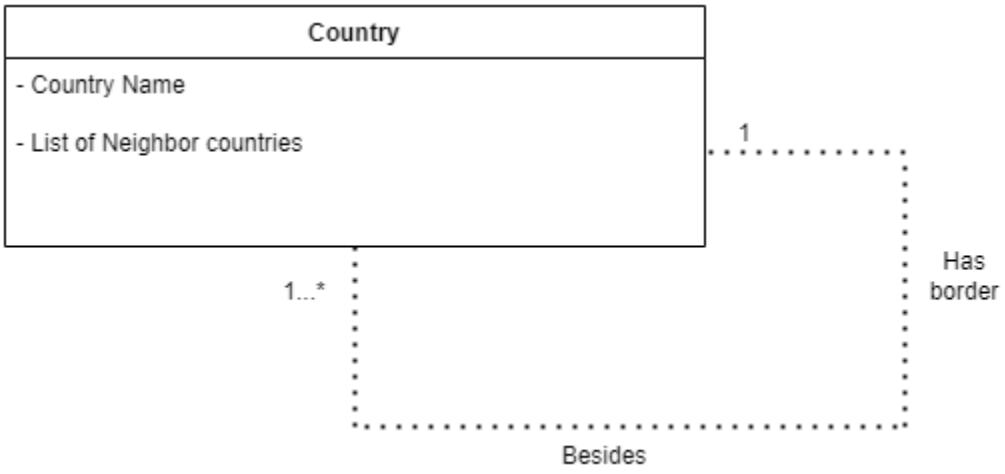
IT-314 Lab-4

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

Figure-1

Answer:-



(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.

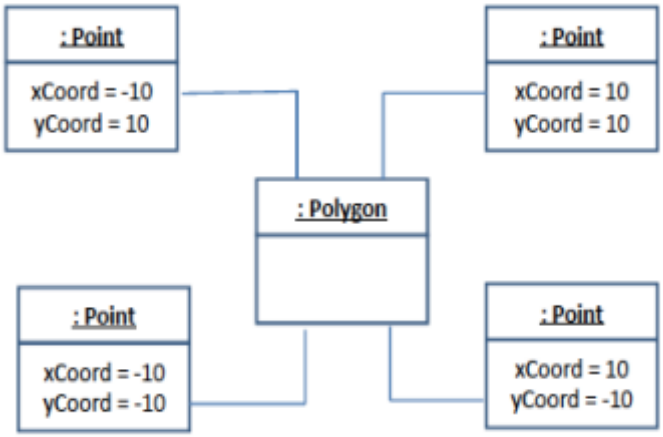


Figure - 2

Answer:-

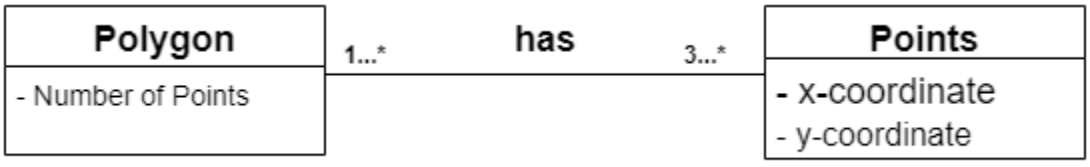
(1) Smallest Number of Points Required to Construct a Polygon

To construct a polygon, the smallest number of points required is **3**. This is because a polygon is defined as a closed shape with at least three sides.

- **Triangle** is the simplest polygon and has exactly 3 points.

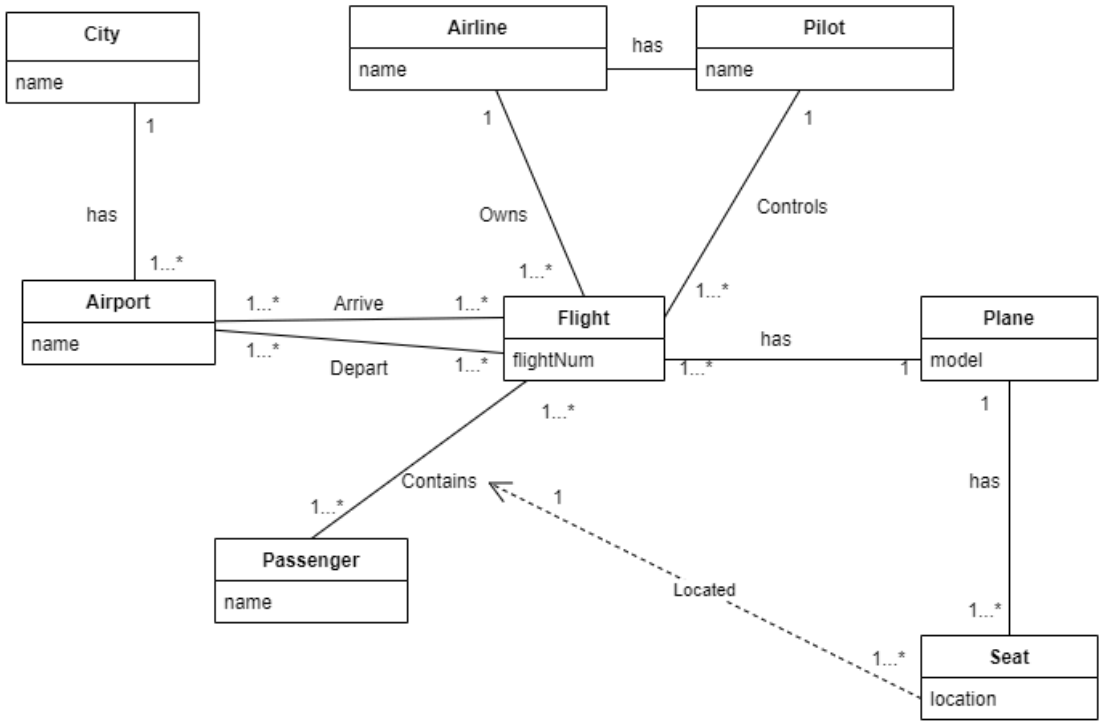
(2) Sharing Points Between Polygons

- **If points are shared**: Sharing points between polygons doesn't change the minimum number of points needed to form a polygon. Each individual polygon still requires at least 3 unique points to be defined, but those points can be shared among multiple polygons.
- **If points are not shared**: If points cannot be shared between polygons, each polygon must have its own set of at least 3 distinct points.
- **Ordered Points**: In both cases, points are typically ordered to define the sequence in which they connect to form edges. For instance, a triangle is defined by an ordered triplet of points.



(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.

Answer:-



(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.

Answer:-

Entities and Attributes

1. **Airline**
    - **ID** (Primary Key)
2. **Airport**
    - **ID** (Primary Key)
    - **Name** (Optional)
3. **Flight**
    - **ID** (Primary Key)
    - **Departure Airport ID** (Foreign Key, references Airport)
    - **Arrival Airport ID** (Foreign Key, references Airport)
    - **Pilot ID** (Foreign Key, references Pilot)
    - **Co-Pilot ID** (Foreign Key, references Pilot)
    - **Aircraft ID** (Foreign Key, references Aircraft)
    - **Departure Time**
    - **Arrival Time**
    -
4. **Aircraft**
    - **ID** (Primary Key)
    - **Type** (e.g., Model, Make)
    - **State** (e.g., Working, Under Repair)
    - **Status** (e.g., Landed, Airborne)
5. **Pilot**
    - **ID** (Primary Key)
    - **Experience Level** (e.g., 1 to 3)
6. **AircraftType**
    - **Type ID** (Primary Key)
    - **Required Pilots** (e.g., Captain, Co-Pilot, Navigator)
    - **Min Experience Level** (e.g., Captain must be level 3)

Relationships

1. **Airline and Aircraft**

    - An airline owns multiple aircraft.
    - Each aircraft belongs to one airline.
2. **Flight and Aircraft**
    - A flight uses one aircraft.
    - Each aircraft can be used in multiple flights.
3. **Flight and Pilot**
    - A flight has one pilot and one co-pilot.
    - Pilots can be assigned to multiple flights.
4. **Pilot and AircraftType**
    - A pilot's role (e.g., Captain, Co-Pilot) is matched with the required roles for a specific aircraft type.
    - Each pilot has a specific role based on the aircraft type they are assigned to.
5. **Aircraft and AircraftType**
    - Each aircraft is of a specific type.
    - Each aircraft type has specific requirements for pilots.

Constraints

1. **Pilot Experience Levels:**
    - A captain must have an experience level of 3.
    - A co-pilot can have any experience level.
2. **Aircraft Requirements:**
    - Each aircraft type requires at least one captain and one co-pilot.
    - The number of pilots and their roles are specified for each aircraft type.