Assignment 1 - Spatial Databases

Exercise 1

A shipping company has a database to keep track of their boats. An inventory of all the past and currently used shipping lanes is kept, that is, the routes taken by boats from one port to another. When moving, each boat has its real position updated every hour. The company also keeps track of the crew present on their boats. Each crew member has a role on the boat, that can change throughout her career. An excerpt from the database is as follows:

- Boat(BoatId, FromDate, ToDate, Name, Capacity)
    - FromDate is the commissioning date of the boat
    - ToDate is the decommissioning date, it is NULL if the boat is still in service
- ShippingLane(LaneId, Geom)
    - Geom is a multiline geometry
- Position(BoatId, Time, LaneId, Geom)
    - BoatId references Boat.BoatId
    - LaneId references ShippingLane.LaneId
    - Time is a timestamptz
    - Geom is a point geometry
- Crew(CrewId, FirstName, LastName, Street, City, Zip, Country, Phone)
- Managed(CrewId, FromDate, ToDate, Manager)
    - CrewId references Crew.CrewId
    - Managed references Crew.CrewId
    - FromDate is the date upon which the crew member was put under her manager
    - ToDate is the date upon which he stopped being under her manager
- Role(CrewId, FromDate, ToDate, Role)
    - CrewId references Crew.CrewId
    - FromDate marks the start of the role of a crew member
    - ToDate marks the end of the role
- PartOf(CrewId, FromDate, ToDate, BoatId)
    - CrewId references Crew.CrewId
    - BoatId references Boat.BoatId
    - FromDate is the date the crew member has arrived on the boat
    - ToDate is the date when the crew member left the boat

For the following queries, suppose you are using a PostgreSQL database with the PostGIS extension. We also suppose that the geometries are in the SRID 4326 (WGS84) spatial reference system.

Express in SQL the following spatial queries.

Query 1. List the name of boats that have deviated from their shipping lane by more than one kilometer, and the most recent time when they did this.

Query 2. For each boat, find how far it has gone on its latest shipping lane. This progress will be presented as a percentage of the total length of the shipping lane.

Query 3. For each boat, count how many boats it has crossed so far. We suppose two boats have crossed each other if they have been ever less than 500 meters from each other.

Query 4. Find the shipping lanes that cross the shipping lane where the oldest boat (that is still running) has last been.

Exercise 2

Load the database dump belgium_input.sql, representing spatial information about Belgium. Express in SQL the following spatial queries

Query 1. Draw a line between cities in Flanders and Wallonia that are less than 30~km away from each other.

Query 2. Display in QGIS the result of the previous query. Also, change the distance to 60~km and 10~km, display the results graphically, and compare.

 Query 3. Compute the provinces that contain cities that are at an altitude higher than 300~m above sea level, and at less than 2~km from a river.

Query 4. Compute and display in QGIS the longest road by province.

Exercise 3

Transform the geometric data in Exercise 2 so that they are represented in the SRID 4326. Then, write the queries in the lecture slides and in Exercise 2 again, and comment on the differences.