CSCI 5751: Homework 1

Our answers are italicized.

Chapter 1: Introduction to Spatial Databases

- **Q 1.8 :** Sorting is a popular method to access "traditional data" rapidly. Why is it difficult to sort spatial data?

There is no unique way to sort spatial data. For traditional data you can easily sort it by name or unique ID, however there is not a way to translate this to spatial data. If, for example, I have a point file – I can sort based on latitude, name, ID, etc. but I lose my spatial proximity. Sorting based on these columns or attributes does not preserve neighbors and near points. There is no easy way to sort on "proximity" or "geometry". Even if I were to sort on latitude, I would lose the longitude and the points would again not be sorted spatially. No total ordering can preserve proximity completely - however some ways are better than others.

Chapter 2: Spatial Concepts and Data Models

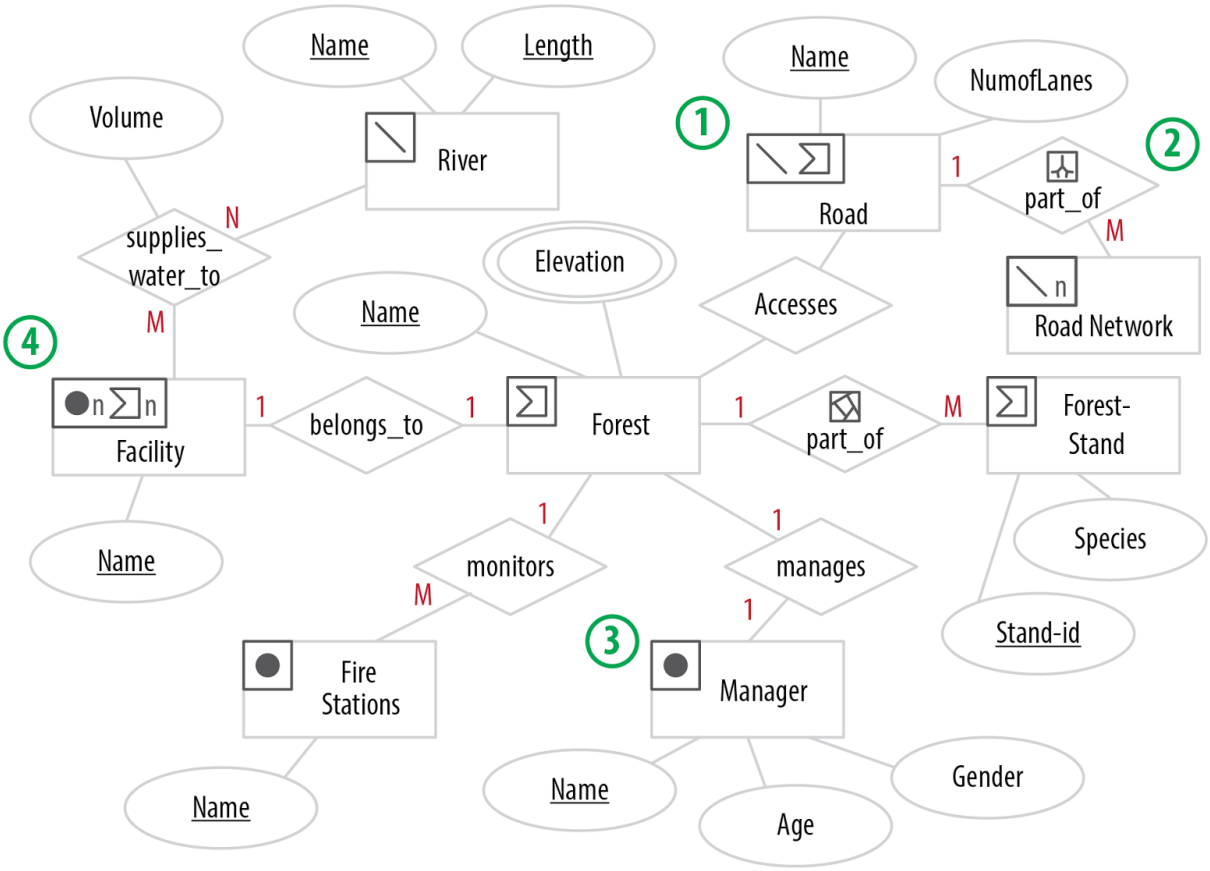
- **Q 2.4 :** Match the columns:
    1. Nominal Temperature in Celsius *(3)*
    2. Ordinal Temperature in Kelvin *(4)*
    3. Interval Social security number *(1) consists of numbers but used as a label*
    4. Ratio Color spectrum *(2)*

Q 2.18 : Study the ER diagrams in Figure 2.4. What does it specify about the following questions?

1. How many forests can a manager manage?
   The relationship is a 1 to 1 relationship so a manager can only manage 1 forest.
2. How many forest-stands can a manager manage?
   A manager can manage many forest stands.
3. How many fire-stations can monitor a forest?
   Multiple stations can monitor a forest, but a station can only monitor one forest.
4. How many facilities can belong to a forest?
   One facility can belong to a forest.
5. What are the spatial relationships between rivers and forests?
   Rivers supply facilities which are within the forest. They also pass under roads that access the forest. Looking at these relationships - one can say that some rivers are within the forest and others are disjoint.
6. What are the spatial relationships among forest-stands in a forest?
   Forest stands are a part of the forest. This means that forest stands can be

adjacent neighbors.

- **Q 2.21 :** Revise the ER diagram with pictures in Figure 2.7 to allow the following requirements:
    1. Roads may have a spatial representation of line-strings (e.g., center-line) or polygons (e.g., land parcel occupied).
    2. Facilities may have a spatial representation of point collection or polygon collection.
    3. Roads are parts of a road network.
    4. Manager have a mailing address and a map location.



Chapter 3: Spatial Query Languages

- **Q 3.9 :** Express the following queries in SQL, using the OGIS specified datatypes and operations
    1. List all cities in City table which are within five thousand miles of Washington, D.C.

```
SELECT C.Name
```

```
FROM City C, City B
WHERE Distance(C.Shape, B.Shape) <= 5,000
AND B.Name = "Washington D.C."
AND C.Name <> "Washington D.C."
```

2. What is the length of Rio Paranas in Argentina and Brazil?

```
SELECT R.Length
FROM River R, Countries C
WHERE Cross(R.Shape, C.Shape) = 1
AND R.Name = "Rio Paranas"
```

3. Do Argentina and Brazil share a border?

```
SELECT C2.Name
FROM Country C1, Country C2
WHERE Touch(C1.Shape, C2.Shape)=1
AND C1.Name = "Argentina"
AND C2.Name = "Brazil"
```

4. List the countries that lie completely south of the equator.

```
SELECT C.Name
FROM Country C
WHERE Point((C.Shape.x < 0), C.Shape.y)
```

- **Q 3.12 :** How would one model the following spatial relationships using 9-intersection model or OGIS topological operations?
    1. A river (LineString) originates in a country (Polygon)
       9 - Intersection Model: Overlap
       OGIS: A river CROSSES (or Overlaps) a country
    2. A country (e.g., Vatican city) is completely surrounded by another (e.g., Italy) country
       9 - Intersection Model: Meet
       OGIS: Vatican City TOUCHES Italy

    3. A river (e.g., Missouri) falls into another (e.g. Mississippi) river
       9 - Intersection Model: Meet
       OGIS: The Missouri TOUCHES the Mississippi

4. Forest stands partition a forest
   9 - Intersection Model: Inside
   OGIS: Forest stands are WITHIN a forest

- **Q 3.18 :** Revisit relational schema for state park example in Section 2.2.3. Outline SQL DML statements to create relevant tables using OGIS spatial data type.

```
CREATE TABLE Forest {
      name              VARCHAR(35),
      shape             polygon,
      PRIMARY KEY       (name) };

CREATE TABLE Forest-Stand {
      stand-id          int,
      species           varchar(35),
      shape             polygon,
      PRIMARY KEY       (stand-id) };

CREATE TABLE River {
      name              varchar(35),
      length            real,
      shape             linestring,
      PRIMARY KEY       (name) };

CREATE TABLE Road {
      name              varchar(35),
      numoflanes        int,
      shape             linestring,
      PRIMARY KEY       (name) };

CREATE TABLE Facility {
      name              varchar(35),
      forest-name       varchar(35),
      forest-name-2     varchar(35),
      shape             point,
      PRIMARY KEY       (name) };

CREATE TABLE Fire-Station {
      name              varchar(35),
      forname           varchar(35),
      shape             point,
      PRIMARY KEY       (name) };
```

```
CREATE TABLE Manager {
      name              varchar(35),
      age               int,
      gender            varchar(6),
      forname           varchar(6),
      PRIMARY KEY       (name) };
```