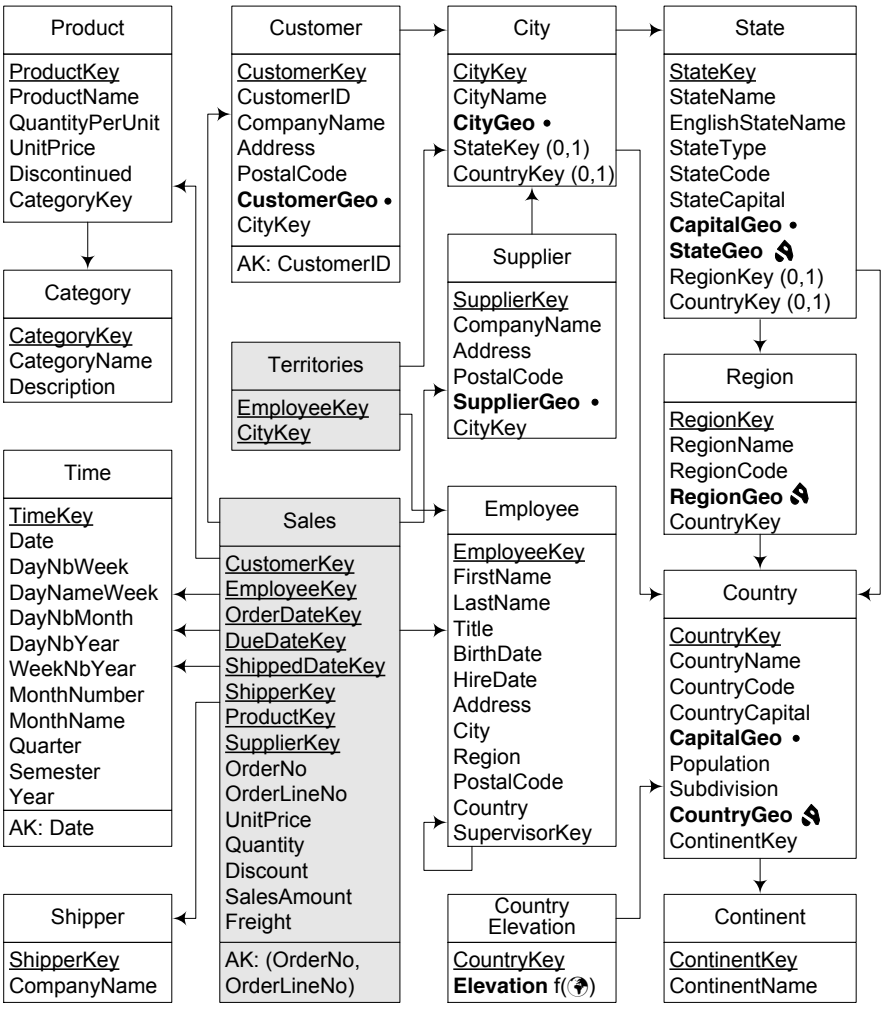
INFO-H-415 - Advanced Databases

Session 12 - Spatial Databases (3/3)

For this session, we consider the following spatial relational diagram of the GeoNorthwind database.



Exercise 1. Give the total sales in 1997 to customers located in cities that are within an area whose extent is a polygon drawn by the user. For the purpose of the exercise, we will consider the following coordinates for the polygon's opposite corners: (5, 40) and (100, 90).

Exercise 2. What are total sales to customers located in a state that contains the capital city of the country?

Exercise 3. Give the spatial union of the states in the USA where at least one customer placed an order in 1997.

Exercise 4. What is the distance between the customers' locations and the capital of the state in which they are located?

Exercise 5. For each customer, give the total sales amount to its closest supplier.

Exercise 6. Give the total sales amount for customers that have orders delivered by suppliers such that their locations are less than 200 km from each other.

Exercise 7. What is the distance between the customer and supplier for customers that have orders delivered by suppliers of the same country.

Exercise 8. Give the number of customers for European countries with an area larger than 50,000 km^2.

Exercise 9. For each supplier, give the number of customers located at more than 100 km from the supplier.

Exercise 10. For each supplier, give the distance between its location and the centroid of the locations of all its customers.

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Solutions for Session 12 - Spatial Databases (3/3)

➤ Solution to Exercise 1

Beware that you have to specify the SRID of the polygone and to "cast" the Geography-typed result to a Geometry type (with the `::geometry` statement) because the function `ST_Within` only accepts geometry.
To check your restults, you could add the following column to the query: `ST_AsText(Y.CityGeo) AS City`.
Note that you could also use the `ST_GeographyFromText` function to interpret the polygon string into a geography, but you still would have to cast it into a geometry type. Practically, you could replace

```
'SRID=4326;POLYGON((5.0 40.0, 100 40.0, 100.0 90.0, 5.0 90.0, 5.0 40.0))'::geometry
```

by

```
ST_GeomFromText('SRID=4326;POLYGON((5.0 40.0, 100 40.0, 100.0 90.0, 5.0 90.0, 5.0 40.0))')
```

➤ Solution to Exercise 2

```
SELECT C.CompanyName AS Customer,
       SUM(S.SalesAmount) AS TotalSales
  FROM Sales S,
       Customer C,
       City Y,
       State A,
       Country O
 WHERE S.CustomerKey = C.CustomerKey
   AND C.CityKey = Y.CityKey
   AND Y.StateKey = A.StateKey
   AND A.CountryKey = O.CountryKey
   AND ST_Contains(A.StateGeo,O.CapitalGeo)
 GROUP BY C.CompanyName
```

Note that, like for the previous exercise, you could also use the `ST_Within` function (and swap the parameters).

➤ Solution to Exercise 3

```
SELECT ST_AsText(ST_Union(DISTINCT A.StateGeo)) AS States
  FROM Sales S,
       Customer C,
       City Y,
       State A,
       Country O,
       Time T
 WHERE S.CustomerKey = C.CustomerKey
   AND C.CityKey = Y.CityKey
   AND Y.StateKey = A.StateKey
   AND A.CountryKey = O.CountryKey
   AND O.CountryName = 'United States'
   AND S.OrderDateKey = T.TimeKey
   AND T.Year = '1997'
```

➤ Solution to Exercise 4

```
SELECT C.CompanyName AS Customer,
       ST_Distance(C.CustomerGeo,A.CapitalGeo) AS Distance
  FROM Customer C,
       City Y,
       State A
 WHERE C.CityKey = Y.CityKey
   AND Y.StateKey = A.StateKey
 ORDER BY C.CompanyName
```

➤ Solution to Exercise 5

```
SELECT C.CompanyName AS Customer,
       SUM(S.SalesAmount) AS TotalSales
  FROM Sales S,
       Customer C,
       Supplier U
 WHERE S.CustomerKey = C.CustomerKey
   AND S.SupplierKey = U.SupplierKey
   AND ST_Distance(C.CustomerGeo,U.SupplierGeo)
          <= (SELECT MIN(ST_Distance(C.CustomerGeo,U1.SupplierGeo))
                FROM Sales S1,
                     Supplier U1
               WHERE S1.CustomerKey = C.CustomerKey
                 AND S1.SupplierKey = U1.SupplierKey)
 GROUP BY C.CompanyName
```

Note that this query is assuming that we cannot have two closest suppliers for any customer. Should we want to take this case into account, then the query could be extended as follows:

```
SELECT C.CompanyName AS Customer,
       U.CompanyName AS Supplier,
       SUM(S.SalesAmount) AS TotalSales
  FROM Sales S,
       Customer C,
       Supplier U
 WHERE S.CustomerKey = C.CustomerKey
   AND S.SupplierKey = U.SupplierKey
   AND ST_Distance(C.CustomerGeo,U.SupplierGeo)
          <= (SELECT MIN(ST_Distance(C.CustomerGeo,U1.SupplierGeo))
                FROM Sales S1,
                     Supplier U1
               WHERE S1.CustomerKey = C.CustomerKey
                 AND S1.SupplierKey = U1.SupplierKey)
 GROUP BY C.CompanyName, U.CompanyName
```

➤ Solution to Exercise 6

```
SELECT C.CompanyName AS Customer,
       SUM(S.SalesAmount) AS TotalSales
  FROM Sales S,
       Customer C,
       Supplier U
 WHERE S.CustomerKey = C.CustomerKey
   AND S.SupplierKey = U.SupplierKey
   AND ST_Distance(C.CustomerGeo,U.SupplierGeo) < 200
 GROUP BY C.CompanyName
```

➤ Solution to Exercise 7

```
SELECT DISTINCT C.CompanyName AS Customer,
       U.CompanyName AS Supplier,
       ST_Distance(C.CustomerGeo,U.SupplierGeo) AS Distance
  FROM Sales S,
       Customer C,
       City Y,
       State A,
       Supplier U,
       City AS SY,
       State AS SA
 WHERE S.CustomerKey = C.CustomerKey
   AND C.CityKey = Y.CityKey
   AND Y.StateKey = A.StateKey
   AND S.SupplierKey = U.SupplierKey
   AND U.CityKey = SY.CityKey
   AND SY.StateKey = SA.StateKey
   AND SA.CountryKey = A.CountryKey
 ORDER BY C.CompanyName, U.CompanyName
```

➤ Solution to Exercise 8

```
SELECT O.CountryName AS Country,
       COUNT(DISTINCT S.CustomerKey) AS NbCustomers
  FROM Sales S,
       Customer C,
       City Y,
       State A,
       Country O,
       Area R
 WHERE S.CustomerKey = C.CustomerKey
   AND C.CityKey = Y.CityKey
   AND Y.StateKey = A.StateKey
   AND A.CountryKey = O.CountryKey
   AND ST_Area(O.CountryGeo) > 5
   AND O.AreaKey = R.AreaKey
   AND TRIM(R.AreaName) = 'Europe'
 GROUP BY O.CountryName
```

➤ Solution to Exercise 9

```
SELECT U.CompanyName AS Supplier,
       COUNT(DISTINCT C.CustomerKey) AS CustomerCount
  FROM Sales S,
       Supplier U,
       Customer C
 WHERE S.SupplierKey = U.SupplierKey
   AND S.CustomerKey = C.CustomerKey
   AND ST_Distance(U.SupplierGeo,C.CustomerGeo) > 100
 GROUP BY U.CompanyName
```

➤ Solution to Exercise 10

```
SELECT U.CompanyName AS Supplier,
       ST_Distance(U.SupplierGeo, ST_Centroid(ST_Union(DISTINCT C.CustomerGeo))) AS Distance
  FROM Sales S,
       Supplier U,
       Customer C
 WHERE S.SupplierKey = U.SupplierKey
   AND S.CustomerKey = C.CustomerKey
 GROUP BY U.CompanyName,
          U.SupplierGeo
```