Institut für Informationssysteme
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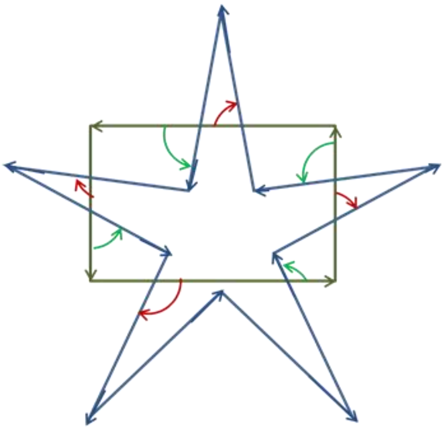
Spatial Databases and GIS

Solution for Sheet 3

Exercise 1 (Geometric Operations)

What steps are necessary to determine the area of the intersection of two polygons.

a. If both are given as vector geometry?
   - Determine the linear equations for all edges of both polygons.
   - Calculate the intersection points and check if they are on both edges.
   - Calculate the angles between the intersecting edges. The direction is important (see picture below)



   - Start with one intersection point, if the angle between P1(the olive rectangle in the picture above) and P2 (blue star) is positive (then the angle is marked with a green arrow) follow the edges of P2 to the next intersection point otherwise the edges of P1.
   - Calculate the area of the polygon.

b. If both are given as raster geometry?
   If the raster width and origin are the same, you have to check for each cell belonging to the first polygon if it also belongs to the second one. If so you have to increment a counter for the area.
   If the raster width or origins are different you have to transform one raster to the other first.

c. If one polygon is given as raster and the other as vector geometry?

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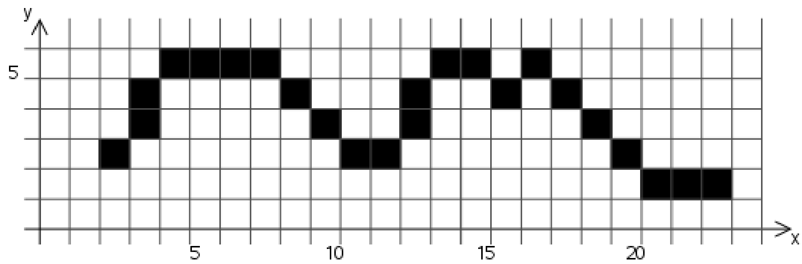
1) *Consider the center of every cell belonging to the raster polygon as a point and und use a point-in-polygon algorithm to check if it is within the vector polygon and count those that are.*
2) *Rasterize the vector polygon. And then b)*
3) *Vectorize the raster polygon and then a)*

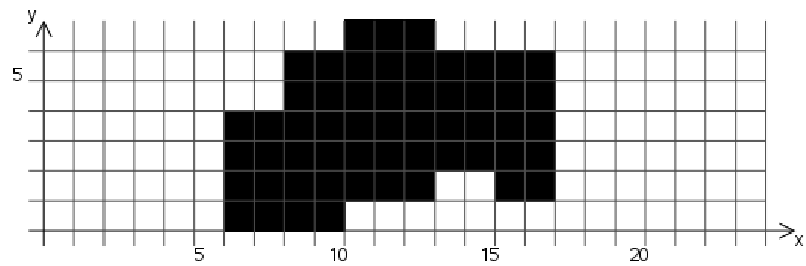
d. Which of those cases is the easiest?
b. if the raster-width and origin are the same.

2. Compress the line using the chain code and calculate the length using the compressed line.



Chain code: ne-n-ne-e-e-e-se-se-se-e-ne-n-ne-e-se-ne-se-se-se-se-e-e
To calculate the length:
chessboard distance: count the directions and add one: 23

3. Compress the polygon using the blockcode and calculate the centroid using the compressed polygon.



Block code: 6,0,4 – 8,4,2 – 10,4,3 – 10,1,3 – 13,2,4 – 15,1,1 – 16,1,1
Centroids of the squares (coordinate +(size)/2):
x-coordinate: 8 – 9 – 11.5 – 11.5 – 15 – 15.5 – 16.5
y-coordinate: 2 – 5 – 5.5 – 2.5 – 4 – 1.5 – 1.5
centroid of the polygon:
*x-coordinate: (16*8 + 4*9 + 9*11.5 + 9*11.5 + 16*15 + 15.5 + 16.5)/56 ≈ 11.5*
y-coordinate: ≈3.5

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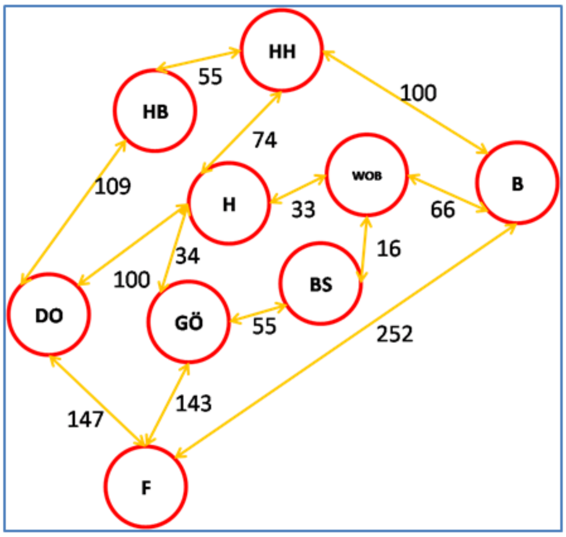
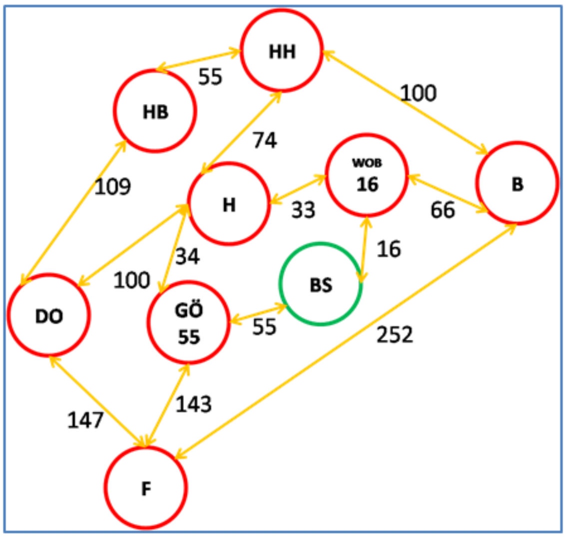
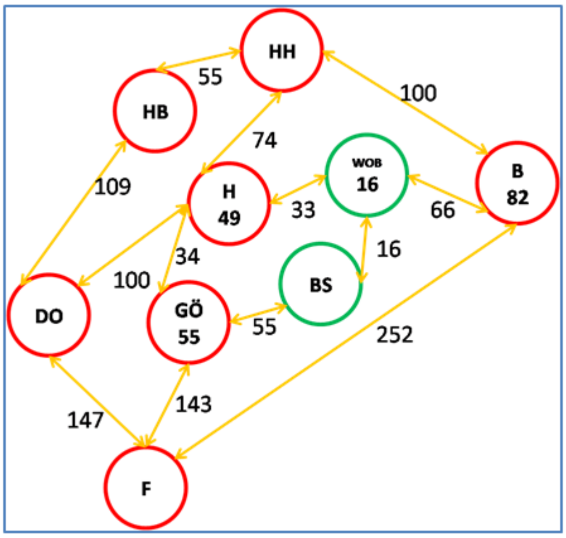
Exercise 2 (Shortest Path Problem)

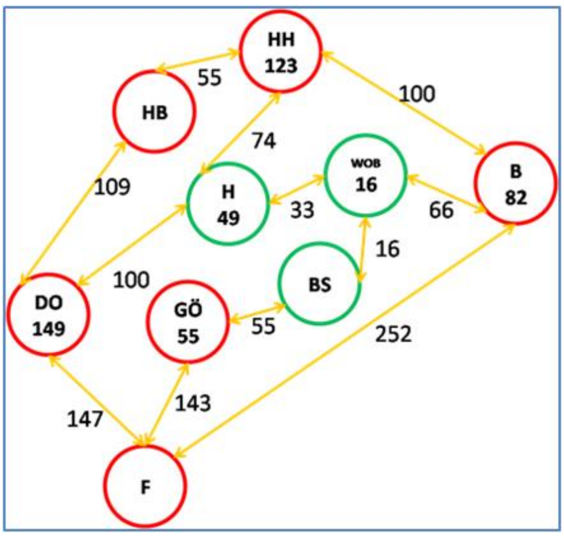
The graph given below show ICE-connections between some german cities. The weight of each edge is the time needed to cover that distance.

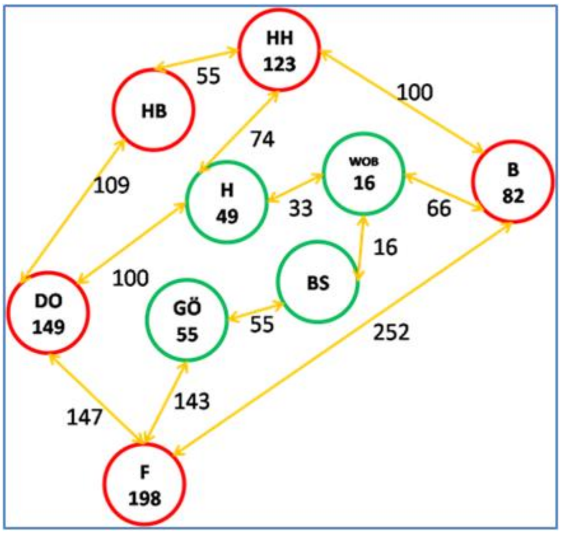
1. Calculate the path with the shortest driving time from Braunschweig to every other city using one of the three algorithms presented on slides 203 to 205.
   Dijkstra:
   - Start with BS
   - Update distances to its neighbours
   - Delete edges if a shorter way to that neighbour is already known.
   - Continue with the node with the shortest distance that hasn't been visited (green) yet.

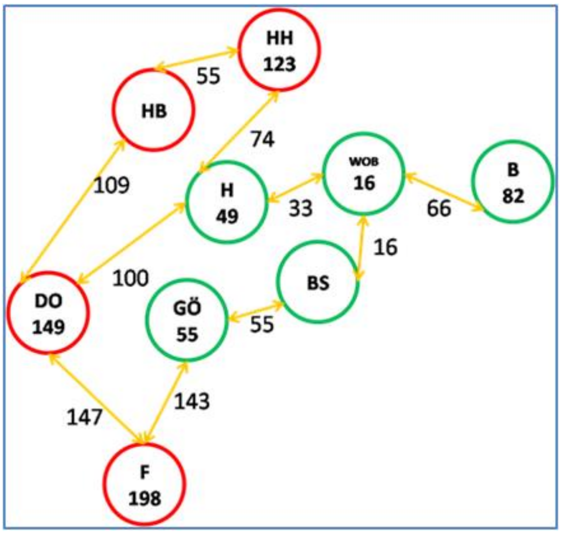


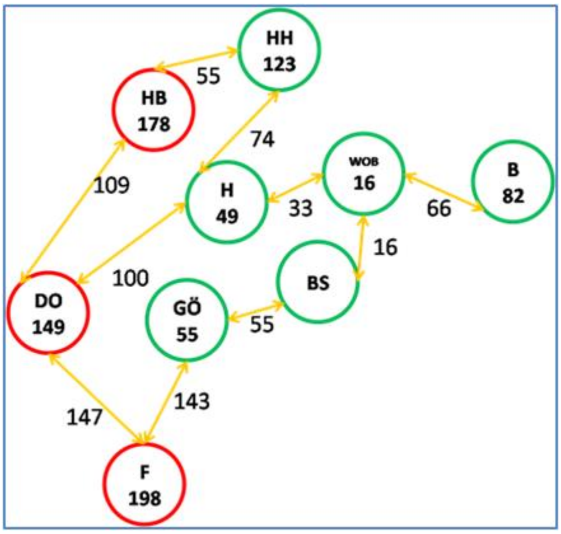


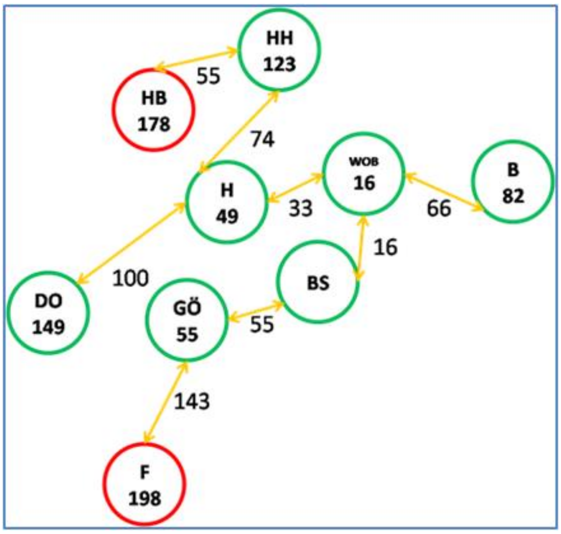












2. Why did you choose that algorithm?
   Because it has the best runtime.