Lab Assignment 11 - Routing

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The text “GIS i Danmark 2”, pages 125 - 134 can be downloaded from

Campusnet (file “Ruteoptimering.pdf”).

Exercise 1 - Shortest Path Trees

In “GIS i Danmark 2”, page 126 you will find a map and a distance table for Bornholm. On page 130 there is a description of Dijkstra’s Single Source Shortest Path algorithm - this is also given in the slides for the lecture. Find with Ronne as source (origin) the shortest path to each of the other locations on Bornholm.

Exercise 2 - Minimum Spanning Trees

A tree is a set of edges in a graph containing no circuit. A spanning tree includes all vertices. A minimum spanning tree is a tree with minimum weight among all spanning trees. Minimum spanning trees are interesting e.g. in connection with high-capacity backbone communication networks. Find a minimum spanning tree for Bornholm with the given locations and edges. Describe your method.

Exercise 3 - the Travelling Salesman

Find the shortest Hamiltonean circuit on Bornholm, i.e. the shortest circuit visiting each city exactly once. Argue that your solution is actually the shortest circuit.

Exercise 4 - the Chinese Postman

The shortest postman tour in the Bornholm network can be found as follows:

* Find all vertices of odd degree, i.e. with an odd number of incident edges.
* Construct a complete network of these vertices - the distance between each pair of vertices must be the one given in the distance table of Figure 1.
* Match the vertices in pairs, such that the sum of the distances between matched vertices is as small as possible.
* Identify the paths corresponding to the edges in the matching. Add each of these paths to the network, even if it is already present.
* Now each vertex is of even degree - find a circuit in the network visiting each edge exactly once (a Eulerian tour).

Carry through this construction.

Deliverables: A report containing the answers 1-4.