

Portfolio Project 3

This portfolio is about graph algorithms. The portfolio is part of the full portfolio for the course with the previous two parts submitted earlier. All three parts must be submitted together for the exam. The previous parts can be included as submitted earlier or adapted using comments you have received.

The full portfolio will have three parts. Each part can be done in groups of up to four students. For each part you should list with whom you have made that part of the portfolio. The exam is individual, and you must be able to answer questions related to all parts of your portfolio. For all parts your solution may include code snippets from lectures.

The submission should contain a pdf document for description and discussions and a zip file of source code.

Submission deadline for the full portfolio: May 4th at 10AM via eksamen.ruc.dk

The final submission of the full portfolio is limited to 48,000 characters, including spaces.

All students must submit the final version of the full portfolio via eksamen.ruc.dk on May 4th

Description

The portfolio focuses on the shipping departments management of shipping routes.

The shipping company currently uses eight fixed shipping routes that partially overlap. Each route will have a number of stops at ports where passage between ports takes a fixed number of days.

An employee has heard about minimum spanning trees and argued that it would be an idea to simplify the shipping routes. The current routes are listed in a file with ports and duration.

The assignment consists of the following parts

1. Read the file of the current route network and represent it as a graph
2. Check that the graph is connected so that there is a possible route between any two ports
3. Construct the minimum spanning tree of the graph

Part 1

You should read the file of the current route network. The network can be found in a file "network.txt" as a comma separated file of two ports and a travel distance measured in days. The information is based on the Intra Asia Pacific shipping route network¹. You should store the graph as an adjacency list or a matrix graph. The graph should be bidirectional so that any information about connected ports should be stored in both directions. The weights on edges in the graph should be duration of trips measured in days.

¹ <https://www.maersk.com/local-information/intra-asia-pacific-shipping-routes>

Part 2

You should check that the graph is connected. You should check that from a node you can reach all other nodes directly or indirectly. Write the check as a general algorithm that works on the graph representation you have used. What is the complexity of the algorithm?

Part 3

Implement an algorithm for constructing the minimum spanning tree and use it on the graph from our route network. What is the total length (duration) of the minimum spanning tree?