ALYMPIAD FINALS 2005 ASSIGNMENT

Garderen, April 18th and 19th 2005

English

INTRODUCTION

Amberhavn[1] is a typical European medium-sized old city; an authentic old city centre built around the cathedral, surrounded by more modern districts.

One of the most frequent visited sites is the 'Old town' with its beautiful stone wooden houses on the waterfront. This part of amberhavn attracts many tourists who visit amberhavn for a day or two. Amberhavn is surrounded by rivers and canals. Across the water there are four suburbs: Flamburg, Eigenhem, Elave and Fiville.

Amberhavn is one of the oldest university towns in Europe. Part of the university buildings are located in the old town. There is also a large university complex in the south-east of the city. This is where the majority of students follow their lectures. The teaching hospital has an important regional function.

For most Europeans Amberhavn is known as the home town of the European Broadcasting Company. This broadcasting company and its adjacent organisations are housed in a futuric villages of buildings in the north east part of the town. From the moment the broadcasting company chose Amberhavn as its hometown there are many new inhabitants. Many of them settled down in the booming suburb fiville.

In short, Amberhavn is a vibrant city.

Amberhavn Cathedral

Teaching Hospital

European Broadcasting Company

As a result of Amberhavn's vibrancy and growth, it turns out the public transport in the city is no longer functioning optimally.

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[1] The city of Amberhavn has been made up for this finals assignment.

Amberhavn has one bus company, ABC: the Amberhavn Bus Company. As a result of continuous small changes to the bus routes, the bus services and the time table, over time the local bus network has become so chaotic that hardly anybody can understand it anymore. The inhabitants of Amberhavn are complaining that the system is only aimed at getting tourists to their destination as soon as possible, outside visitors are complaining that public transport in Amberhavn is so complicated that it's better to take their own car; which in turn results in complaints from the locals, etc. etc.

Or in other words: Amberhavn 2005 is ready for a completely new bus network.

The Amberhavn city council wants to set up and organise public transport in such a way that both the locals, the people who have to be in Amberhavn for work, study, health, shopping etc. and the tourists are satisfied.

ASSIGNMENT

Your team is going to create, by order of the local council, a plan for this new bus network. The other teams will also be working on this, and are of course your competitors!

You will also test your own plan, and you have to develop a measure to judge the quality of the plans and to compare them.
You will do this through four sub-assignments.

You will find in attachment several street maps of Amberhavn. All sites of significance are pointed out on this map. The A3 maps can be used as worksheets.

The city council has held a preliminary investigation into the flow of traffic in Amberhavn. Of course there are still many people coming to Amberhavn by car – the following data are relevant for public transport::

- Amberhavn has 60 000 inhabitants.
- The inhabitants of Amberhavn should all be within 10 minutes walking distance from a bus stop.
- Elave, Eigenhem, Fiville and Flamburg have their own bus companies. Of course you can reach these suburbs by bus out of Amberhavn.
- All tourist sights must have a bus stop.
- On weekdays about 2000 people from Fiville and another 2000 from elsewhere outside Amberhavn travel to the European agency by bus.
- On weekdays about 5000 students travel to Amberhavn by train
- There is a constant daily flow of about 2000 people from the city, the suburbs and outside to the teaching hospital by bus.
- On average around 3000 tourists visit the city each day, using public transport.

You have no doubt seen them before, schematic drawings of bus or metro routes in a city. They let you work out quickly which bus you need to get. Here you see an example.
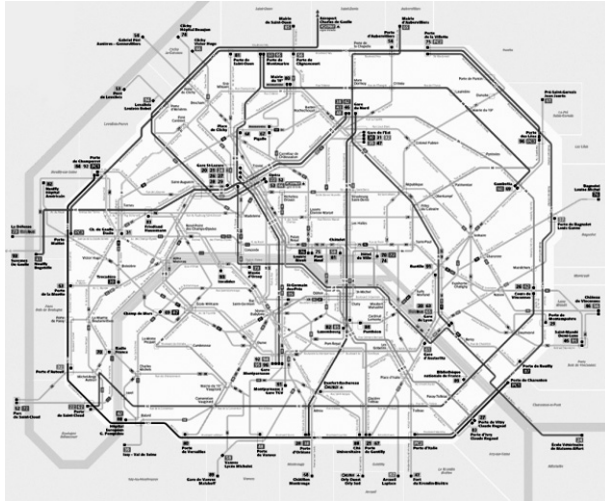
Schematic drawing

Assignment 1   The bus network

Design a bus network scheme for Amberhavn. The scheme must contain all routes and all stops on those routes.

Read all the other three assignments first so you can take them into account while working on the first one. Specially the quality index!

For this assignment you can use the A3 street maps of amberhavn.

Of course your network must meet all the requirements of the preliminary investigation. Data that are not mentioned have to be assumed. Choices have to be made.
These assumptions and choices have to be elaborated in a report about the network.

You will present your bus network scheme on Saturday on a poster with a brief motivation.

A bus network scheme is the first step in designing a complete city bus system. Timetables are also necessary. Many cities have a brochure with the timetable for every route.
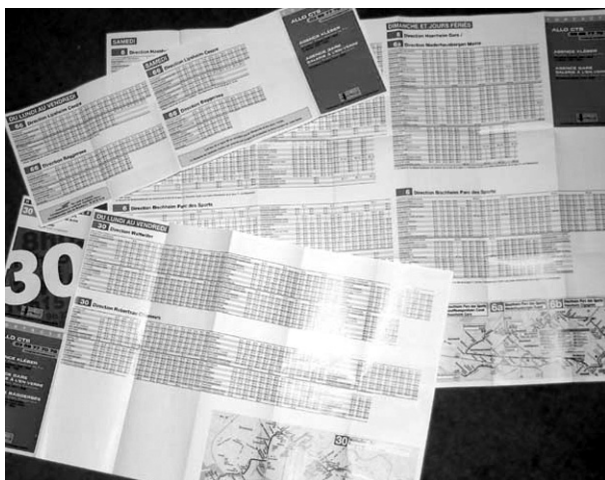
Bus timetable brochures

Assignment 2   The timetable
Make a timetable to go with your bus network scheme.
The timetable must contain every bus movement in some way. Think of your own way to represent the timetable as compact and clearly as possible. Here, too, you will have to use some assumptions. (Remember the quality index!) Include these in your report as well.

It's important for the city council to be able to judge the different proposals on quality. It would be convenient if this could be done quickly, based on a numerical criterion, a so-called 'quality index'.

How would you measure the quality of the different proposals? Which factors play a part? And how do you weigh them?

Assignment 3
Design your own index as a gauge for the quality of the proposed new networks of bus lines you have designed. Substantiate your choices!
Next calculate the value of that index for your own plan. You may use the results of sub-assignment 4 if needed.

The Amberhavn city council wants to set up and organise public transport in such a way that both the locals, the people who have to be in Amberhavn for work, study, health, shopping etc. and the tourists are satisfied. One of the things that play a part here is *travelling time*. This is an aspect of the quality of your bus network that we can 'test'.

On **Saturday morning** you will get from the Alympiade organisation a 'profile' of a journey for eight different travellers. The profile will contain information about point of departure, destination, time and optional extra details.

Assignment 4   The travelling time
Determine for each of these 8 travellers the journey time. The sum of all the journey times will be included on the poster you will present on Saturday.
You will also include them in your report, including of course the calculations and their foundation, and you will indicate how well you think your proposal performs on the aspect 'journey times'.

GUIDE LINES FINAL MATH A-LYMPIADE 2005

BEFORE YOU START:

❑ Read the whole text carefully before you start dividing tasks!
❑ This assignment consists of four sub assignments.
  assignment 1 : making the bus network;
  assignment 2 : designing a timetable;
  assignment 3 : designing a quality index
  assignment 4 : testing the network
❑ Keep assignment 3 in mind, the quality index, while working on the first assignments.

PRODUCTS:

Hand in
A complete report in which you present and your plan to the city council, inclusding foundations and calculations.
The results of the sub assignments will be integrated into this report.

Presenting on saturday afternoon
- a poster with the network you designed in sub assignment 1
- the travelling times of sub assignment 4 (you can off course only calculate these on Saturday morning, after you obtained them).

PLANNING:

- Try to *finish* the first two assignments on friday and elaborate assignment 3 as far as possible.
- The final report is written as an advice to the city council, don't postpone the start of writing this to the very end...
- Your report will be handed in on Saturday, before two o'clock.

Assignment 4: The travelling time

When traveling with public transportation, there are several websites nowadays to help you out. You enter a departure or arrival time, a starting point and a destination. The computer will generate a schedule. An example of such a schedule is shown below:

Schedule of Journey

From prof leon fuchslaan 24, utrecht
To rijnlaan 139, utrecht
Date thursday, 10 march 2005

Departure: **8:59**
Arrival: **9:30**
Travel time: *0:31*
Transfers: **1**

Departure	From	To	Arrival	How
8:59	prof leon fuchslaan utrecht	prof j w dieperinklaan utrecht	9:01	walk 2 min
9:01	prof j w dieperinklaan utrecht	vredenburg utrecht	9:05	bus 138
9:14	vredenburg utrecht	maasplein utrecht	9:29	citybus 1
9:29	maasplein utrecht	rijnlaan utrecht	9:30	walk 1 min

On the next page are eight descriptions of journeys in Amberhavn.
Test your schedule for your bus network by designing time schedules, like the one shown above, for each journey.
Present the total travelling time of all eight journeys on your poster; attach the eight travelling schedules to your report for the city council.

In the descriptions the following location system will be used to specify location within the larger squares on the map:
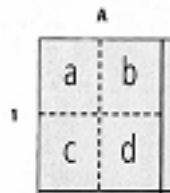
Korteweg family
The Korteweg family lives in Rue Constant Martha 5 (G2c).
They want to go to the movies on Monday night with their kids. The movie starts at
21.15 h in Filmview Theatre, Place Klebert 3 (C3c). The movie lasts for two hours.
Design a schedule for the way back from the movies to the home of the Korteweg
family and calculate their travel time.

Mr. Van Roosmalen
Mr. Van Roosmalen works at the European Broadcasting Company (E2). On
Tuesday he expects a foreign guest. This guest will arrive at 11:45 at the railway-
station (B3). Mr. van Roosmalen collects his guest there. At 12.30 a conference
meeting starts at the European Broadcast Company, that both Mr. van Roosmalen
and his guest have to attend.
Make a schedule for Mr. van Roosmalen from the time of departure at the European
Broadcast Company until his return there and calculate his travel-time.

Pieter Geels
Pieter Geels is a student of mathematics, he lives in Elave. Every Wednesday he has
an Algebra class, by prof. Bourbaki at 09:15, in lecture-room B of the Mathematical
Institute. This Institute is located at the Rue de Rome 7 (E4).
Make a schedule for Pieter Geels' journey to the Mathematical Institute and calculate
his travel time.

Mevrouw Lenders
Mrs. Lenders lives at the Rue d' Oslo 5bis (F4a).
On Wednesday she has a dental appointment at 11:25. The dental practice is located
at Rue de Nideck 17(B5a).
Make a schedule for Mrs. Lenders' journey from her house to the dental practice and
calculate her travel time.

Mrs. Arendson
Mrs. Arendson's mother (aged 85, walking disability) has an appointment at the
University Hospital on Thursday at 9.45. Mrs. Arendson collects her mother at her
home and takes her to the Hospital.
Mrs. Arendson lives at the Rue de Phalsbourg 1 (C2d)
Her mother lives at the Rue Berlioz (F3c).
Make a schedule for Mrs. Arendson's journey.
Calculate the travel time of Mrs. Arendson from her own house, to her mother's
house and from there to the Hospital. Include walking time and transfer time.

Mr. Wekema
Mr. Edema lives at the Rue de Narcisses (E1c) and works as a doorman at the
European Broadcast in Building B at the Avenue du Président Robert Schumann
(E2b). At Friday his shift starts at 15:00 and ends at 23:00.
Make a schedule for his journey to and from his job. Calculate his travel time to and
from his job.

Claire Orange
Claire Orange plans to visit her sister Nadine on Saturday around 11 a.m.
Nadine lives at Rue du St. Quentin (F3bd). Clair lives at the Rue du Jardin (E2a).
Make a schedule for Claire Orange's journey from her house to her sisters house and
calculate her travel time.

Janet Kapowsky

Janet Kapowsky is a tourist. She stays at the Youth Hostel at the Rue du Fosse 7 (C2c).

She leaves on Sunday at 10:05 after a late breakfast, to visit the City Centre. First she wants to go to the old City Centre (see nr. 3).

She has a late lunch at the Quay de la Petite France (B4b). After that she walks around for a while. Just before 15:30 she decides to take a bus to Pont St. Etienne (D3c). Then she walks to the Cathedral (nr. 2) . After visiting the Cathedral she returns by bus to the Youth Hostel. She has an appointment there with a friend at 18:00.

Make a schedule for each separate bus journey and calculate the travel time. Also calculate how much time Janet has to visit the Cathedral.