ITN/LINKÖPINGS TEKNISKA HÖGSKOLA
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TNK082
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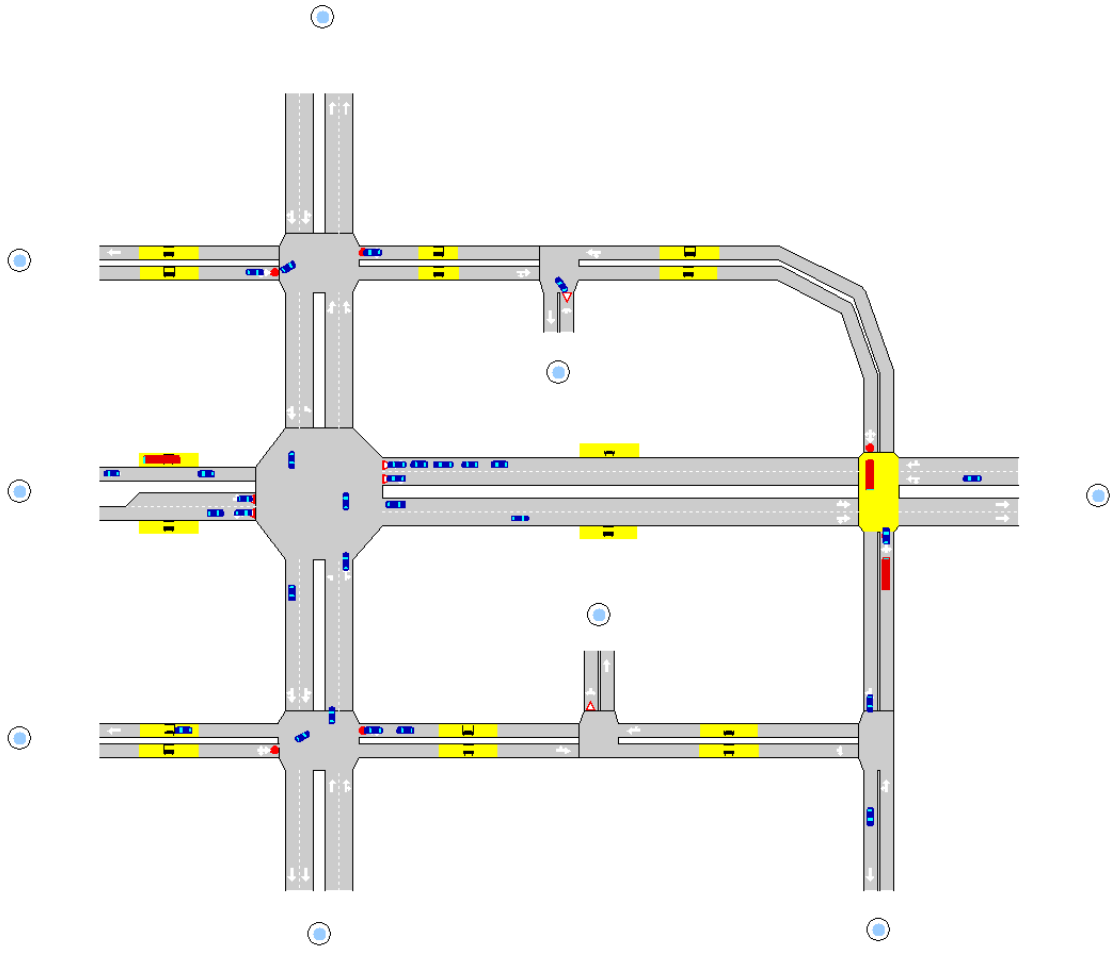
Computer exercise 2

Simulation in AIMSUN/2



Computer exercise 2 – Description

The computer exercise is an introduction to how to conduct simulations using AIMSUN/2. In this computer exercise the networks which were created in computer exercise 1 will be simulated and analyzed. The aim of the exercise is to give basic knowledge on which settings that should or could be changed, which statistics that can be gathered, how to choose and interpret output data, etc.

This exercise consists of 3 obligatory tasks. The first task is to simulate the three obligatory networks from computer exercise 1 and answer questions about traffic flow levels, average speeds, etc. The second task is to run several replications in order to study how well one replication represents the more representative average from several replications. The third and last task is to test different route choice models and analyze how different models affect the result from the simulation.

Menu and tab choices will in this document be marked using **bold** font, e.g. save the network (**File**, **Save as**). Selection or marking of radio buttons or check boxes or writing values in edit boxes will be marked with *italic* font, e.g. set the lane width to 3.5 meters by writing 3.5 in *Lane Width*.

Examination

You have to solve task 1-3 in order to pass the exercise. Present your solutions to the supervisor at the end of the scheduled class.

Settings in AIMSUN/2

Start by open up the AIMSUN program, there is a short-cut on the start-menu under program\GETRAM v4.2.

Load the network

In order to simulate a network, the network and corresponding Result Container **OR** OD-matrix has to be loaded into AIMSUN. Also public transport plans and signal controls, if any, has to be loaded. Following is a description on how to load these different modules:

- Load the network: **File**, **Load Network** and then locate your network in the *Directory* drop-down list.
- Load turn proportions (Result container): **File, Load Traffic Result** and choose the created Container. Mark the created state under *States*. Choose *exponential* arrivals.
- Load the OD-matrix: **File**, **Load O/D Matrix** and choose the created OD-matrix. Choose *exponential* arrivals.
- Load the public transport plan: **File, Load Public Transport.**
- Load the traffic signal control, **File, Load Control**.

It is possible to save a certain combination of network, OD-matrix, signal control, etc in a scenario (**File, Save Scenario**). Next time you want to open this setup is it sufficient to open the scenario (**File, Load Scenario**).

Statistics settings

The results from a simulation in AIMSUN/2 can be illustrated in several ways. It is possible to create reports directly in AIMSUN (**Reports**, **Current Report**, **Statistics**). It is also possible to save the output data in a text-file or in a database, which is preferable. If data is to be stored in a database, copy the file ”getram_42.mdb” from **s:\TN\K\TNK082\Lab 2** to a suitable folder on your home directory**.**

To save the output data in a text file or in a database do the following:

- Text file: **Experiment**, **Output**, **Output Location** and choose *To ASCII Files* and a suitable directory.
- Access database: **Experiment**, **Output**, **Output Location** and choose *To Access Database* and the copy of "getram_42.mdb".

Now it is time to choose which statistics that should be collected and calculated (**Experiment**, **Output**, **Statistics**). Choose for example the following

- *Gather Statistics*.
- *Periodic,* set the *Time interval* to 30 minutes.
- *Store output.*
- *System, Sections* and *Vehicle Types* under the **General** tab.
- *All* and *Turns* under the **Sections** tab**.**

Simulation settings

The simulation should be run for the time period 7^{00} - 9^{00} (**Experiment**, **Run Time**). Set *Simulated Initial Time* to 07.00 and *Simulated End Time* to 09.00. Set *Warm-up period* to 30 minutes.

There are also settings concerning the animation of the vehicles. The vehicles can for example be given different colors depending on their destination (Only possible when using an OD-matrix). In order to do that the different centroids have to be given different colors. Open **View, Preferences** and choose *Centroid* under *Colors* in the tree structure. Click in the *Enable* column for all centroids. Then double click in the *Color* field and choose color by adjusting the color-bars. To color the vehicles by destination choose **View**, **Vehicle Colouring**, **Destination.** It is also possible to color the vehicles by their next turning, vehicle type, etc.

Before running the simulation some settings regarding the driver behavior have to be changed. Open (**Experiment**, **Modelling**) and change the following settings:

- Under the **General** tab:
  - *Simulation Step* = 0.75 s
  - *Reaction Time at stop* = 1.00 s
  - *Queuing Up Speed* = 1.0 m/s
  - *Queue Leaving Speed* = 4.0 m/s.
- Under the **Car Following** tab:
  - *Car Following Model:* 4.2
  - *Apply 2 lanes Car Following model* (mark)
  - *Number of Vehicles* = 4
  - *Max distance* = 100.0 m
  - *Max Speed Difference* = 50 km/h
  - *Max Speed Difference On Ramp* = 70 km/h.
- Under the **Lane Changing** tab:
  - *Percent Overtake* = 0.900
  - *Percent Recover* = 0.950
  - *On Ramp Model*: 3.3.

In order to be comparable, the simulations of the different networks should be run with the same initial values in the random number generator. Set the *Random Seed* number to 3871 in the dialog box (**Experiment**, **Replications**).

Simulation

The simulation can be controlled either via the *Run* menu or via the media player buttons at the bottom of the window. There are several different run options:

- **Run,** simulation with animation. The simulation speed can be controlled using the bar on the right-hand side of the record button.
- **Step,** stepwise simulation, one simulation step per button click.
- **Batch,** simulation without animation.

The simulation can be stopped using (**Run**, **Stop)**. The simulation can be started again using any of the run alternatives. To restart the simulation from the initial start time the simulation has to be reset by pressing the rewind button or **(Run**, **Begin)**.

Results

After a completed simulation, the results can be viewed by opening one of the output text files or the database file. It is recommended to save the data in a database file. This makes it easier to view limited parts of the data and to copy it to other calculation programs as Excel or Matlab.

The database file includes several tables. The following tables are of most interest during this exercise:

- *SectSta*, includes information on flows, travel times, etc. for the different sections.
- *SysSta,* includes flows, travel times, etc. for the whole network.
- *TurnSta,* includes flows, turn times, etc, for all turnings.

In the output text-files the turn statistics is presented in connection with the section statistics.

Some of the columns in the database tables are sometimes difficult to interpret. The following is a explanation of some of the columns.

- *tfrom,* is the start time of the statistics period in seconds, 7^{00} is equal to 25200 seconds after 0^{00}.
- *tto,* is the stop time of the statistics period in seconds, 7^{30} is equal to 27000 seconds after 0^{00}.
- *flow,* is the traffic flow in vehicles/hour.
- *hspd1,* is the harmonic mean speed in km/h. The harmonic mean speed (also known as the *space mean speed*) for a section is the travel mean speed.
- *hspd2*, is the deviation of the space mean speed.
- *ttime1,* is the travel time in seconds.

The definition of the different tables and columns can be found in Appendix 2 in the AIMSUN v4.2 User Manual. The manual is available under s:\GETRAM manualer\.

Task 1 – Simulation of network 1, 2 and 3

Conduct simulations of the networks corresponding to task 1-3 in computer exercise 1. Remember to save the results in different database files. Answer the questions below using statistics from the second half hour period, i.e. $\mathbf{7^{30} - 8^{00}}$.

Network 1 – Turn proportions

1. How large is the traffic flow, the average travel time, and the average speed on the following sections?

Section	Flow	Travel time (s)	Speed (km/h)
4			
10			
11			
12			

2. How large is the total flow in the system?
   Answer:_____ vehicles/h
3. How long is the average travel time in the system?
   Answer:_____ seconds
4. How high is the average speed in the system?
   Answer:_____ km/h
5. How many vehicles turns left from section 10?
   Answer:_____ vehicles

Network 2 – OD-matrix

1. How large is the traffic flow, the average travel time, and the average speed on the following sections?

Section	Flow	Travel time (s)	Speed (km/h)
4			
10			
11			
12			

2. How large is the total flow in the system?
   Answer:_____ vehicles/h
3. How long is the average travel time in the system?
   Answer:_____ seconds
4. How high is the average speed in the system?
   Answer:_____ km/h
5. How many vehicles turns left from section 10?
   Answer:_____ vehicles

Network 3 – Traffic signals

1. How large is the traffic flow, the average travel time, and the average speed on the following sections?

Section	Flow	Travel time (s)	Speed (km/h)
4			
10			
11			
12			

2. How large is the total flow in the system?
   Answer:_____ vehicles/h
3. How long is the average travel time in the system?
   Answer:_____ seconds
4. How high is the average speed in the system?
   Answer:_____ km/h
5. How many vehicles turns left from section 10?
   Answer:_____ vehicles

Comparison of the networks

1. Are the results for Network 1 and Network 2 equal? Why/Why not? Should they be equal?
   Answer:_____
   _____
   _____
   _____
   _____
   _____
2. How does the introduction of traffic signals affect the performance of the Network?
   Answer:_____
   _____
   _____
   _____
   _____

Task 2 – Several replications

Load Network 3. Choose to run replications (**Experiment, Replications**), mark *multiple* and write 10 in *Number of replications* and press the *Create* button. How many replications that are needed when conducting a simulation depend on the desired significance level. You can read more about how to calculate the needed number of replications in the AIMSUN manual in chapter 7.4.1 *Calculation of the number of replications* at page 166. Press *Simulate* in order to start the simulation. Note! All replications are run in batch-mode.

1. Compare the average values from the 10 replications with the results from the replication with Seed 3871. Do the results from the 3871 replication deviate much from the average from the 10 replications?
   Answer:_____
   _____
   _____
   _____

Task 3 – Route choice

All simulations so far have been conducted assuming that all vehicles choose the shortest route between the origin and the destination. AIMSUN offers several options and models for vehicles route choices. The route choices can either be modelled as a fixed or a dynamic choice. Load Network 3. Change the route choice to *fixed (time)* instead of *fixed (distance)* in (**Experiment, Route Choice**). Run the simulation.

1. Did the vehicles route choices change? (Hint: check the turn statistics, for example for left turners from section 10.)
   Answer:_____
   _____
   _____
   _____

Now change the route choice model to a *Multinomial Logit* model. Let the cycle time be 5 minutes, i.e. the shortest paths will be updated every fifth minute. Let the number of intervals be 1 and set the capacity weight to 1, the higher value the higher "punishment" for paths with low theoretical capacity. Choose *Yes* in the *Dynamic* drop-down list. Set *Initial K-Sps* to 1 and *Max number to keep* to 5. Set *Max number of Route* to 3. Finally set the parameter θ in the logit model, to 10. Each vehicle will now choose their route according to the path they observe as the best when they enter the network.

2. Did the vehicles route choices change?
   Answer:_____
   _____
   _____
   _____
   _____

3. Do the route choices vary over time?
   Answer:_____
   _____
   _____
   _____
   _____