A DEVS – Approach to ARGESIM Comparison C16 'Restaurant Business Dynamics' using MatlabDEVS

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Simulator: The MatlabDEVS Toolbox is a DEVS Simulator realized as an object oriented Matlab Toolbox. With the usage of Matlab the simulator shares all advantages and disadvantages of this well known and widely used SCE. The toolbox implements to the greatest possible extent the Abstract Simulator introduced by Zeigler ([1]). It was extended by port definitions and capabilities to simulate dynamic structures by a formalism introduced by Pawletta et. al. ([2]).

Model: The model is implemented as a structure variable coupled DEVS model `MODEL`. This coupled model contains the following atomic models:

- two generators `gen_people` `gen_week` (one for the people going out to eat, another to force the calculation at the end of a week
- a model `switch` to choose a restaurant for a person from the list of possibilities
- a varying number of `restaurant` models (after initialisation 30, then changing)

Figure 1 shows a graphical representation of the model `MODEL` after some weeks of simulation. Through the usage of a *Dynamic Structure* instead of an ordinary DEVS model the *Real World* structure is always mapped in a one to one manner. The simulator needs ca 2300s to simulate 10 years, with a dependency on the number of restaurants.

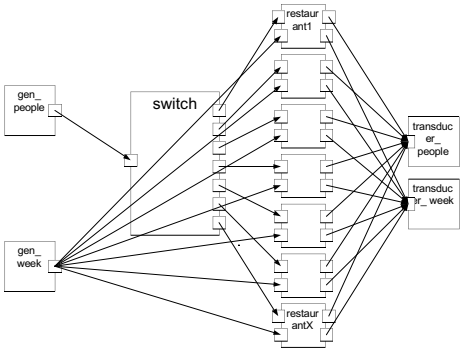

Figure 1: Representation of `MODEL`

Task a - Time Domain Analysis. The warm up period is finished after ca 30 weeks. Figure 2 shows the development of the mean number of restaurants over a simulation time of 10 years and 50 runs.

Results after 5 years are min 3.42, max 4.2, mean 4.24, standard deviation 0.129, and variance 0.026.

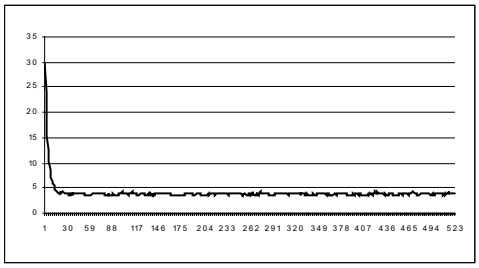

Figure 2: Development of mean number of restaurant in 10 year simulation time

Task b - Tax Income Maximisation. It is possible to use the built-in Matlab optimisation functionality. In this case the `fminbnd` method is suitable. It determined the best tax rate at 39.23%. Figure 3 shows the mean tax income in the tax range from 1% to 99%

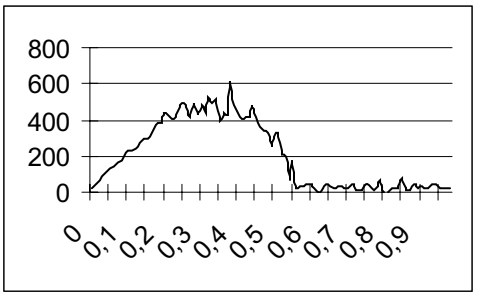

Figure 3: Mean tax income over tax rate fractions

Task c - Restaurants' Revenue Analysis. The simulation with varying parameter *k* did not have an obvious maximum. The results, shown Figure 4, have two very close maxima (difference of only 2.2%)

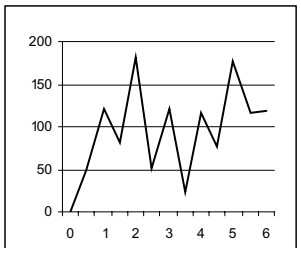

Figure 4: Restaurant revenues over distance parameter *k*

[1] Zeigler B.: Theory of Modelling and Simulation. Wiley-Interscience, Academic Press, 2000

[2] Pawletta Th., et al.: A DEVS Based Approach for Modeling and Simulation of Hybrid Variable Structure Systems. Lect. Notes in Control & Informat. Sciences No. 279, pages 107-129, Springer