Multi-Agent Systems

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Exercise Sheet 7

Due: December 10, 2018, 16:00

Exercise 7.1 (Nagel-Schreckenberg Model, 2+2)

Nagel and Schreckenberg employ cellular automata to model traffic flow.[1] Your task is to represent a concrete traffic situation within the Nagel-Schreckenberg model and to predict the system's future behavior based on the model.

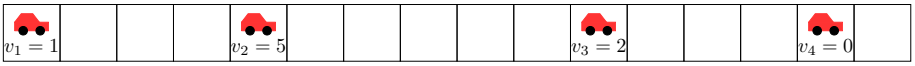

Figure 1: Some traffic situation in the Nagel-Schreckenberg Model

(a) According to the model, what are the possible values for the velocity v_3 of car 3 in the next iteration? Consider the cases $p = 0$, $p = 0.25$ and $p = 1$ (given $v_{\max} = 5$).

(b) Illustrate the most probable successor state for the next two iterations, given that $p = 0.1$, $v_{\max} = 5$, and that car 4 (due to randomization) remains on its cell for the first iteration.

Exercise 7.2 (GOAL and Prolog, 4+4)

Your first task is to install the GOAL framework and familiarize yourself with the environment. You can find information on how to set up everything, as well as tutorials and a very detailed programming guide at `https://goalapl.atlassian.net/wiki`.[2] To get familiar with Prolog, visit `http://lpn.swi-prolog.org`.

(a) Generate the included Hello World example project (in the GOAL perspective click File → New → GOAL example project) and try to understand what is going on (explanations can be found in the programming guide). Take a closer look at HelloWorld10x.mas2g.

(b) Change the agent of the HelloWorld10x-Example to successively print out the numbers of the Collatz sequence[3] beginning with an arbitrary positive integer c_0 (e.g., try it with $c_0 = 27$). The $n+1$-th number in the sequence can be computed by:

$$c_{n+1} = \begin{cases} c_n \ / \ 2 & c_n \text{ is even} \\ 3c_n + 1 & c_n \text{ is odd} \end{cases}$$

The agent's goal is to eventually output number 1.

Please export your Eclipse project as an archive file and submit it to `engesser@cs.uni-freiburg.de`.

[1] Check out the original article: `http://www.pd.infn.it/~agarfa/didattica/met_comp/lab_20140108/1992_origca.pdf`

[2] We have tested the GOAL environment on Ubuntu with a standalone version of Eclipse 2018-09.

[3] `https://de.wikipedia.org/wiki/Collatz-Problem`