CARLETON UNIVERSITY
Department of Systems and Computer Engineering

SYSC 5104. METHODOLOGIES FOR DISCRETE EVENT MODELLING AND SIMULATION

The goal of this document is to present a set of possible subjects to be developed as Term Projects. The detailed specifications for each project will be discussed in detail with each of the groups/individuals.

Important dates:

March 31	Term project choice deadline
April 7	Work in Progress presentations
April 26	**Delivery of the Term Project final software and report**

Deliverables and grades

The details of the deliverables will be discussed in detail for each of the projects. In every case, you should include a 15-20 pages Term Paper explaining the results of your project, showing any results obtained, using IEEE, ACM or SCS format). It should include a brief description of each of the models used (as a conceptual model definition), besides the formal specification. The Term Paper should be organized into:

1. Introduction (brief description of the project, ideas, background and results obtained)
2. Background (any detailed information about background needed for the project)
3. Models defined (including an explanation of the models you built, any rules involved, and general description of the ideas implemented)
4. Simulation results (showing execution of the models in the simulation engine, and analyzing the results obtained. This should include videos of interesting simulation results, if available)
5. Conclusions
6. References

Any source code should run cleanly in the simulation tools, using similar guidelines than the ones used in Assignment 1 and 2.

The term projects will be presented in a "mini-conference" to be held in class. The presentation is part of the final mark. There will be a "Best-Paper" award. The best projects will be invited to be extended to be submitted for publication, if the students are interested. The term projects will be published on-line in the course webpage for perusal of interested modelers.

Formatting instructions for the Term Papers:
http://www.acm.org/sigs/publications/proceedings-templates
http://www.scs.org/PDFs/formattingkit.pdf

(a good example on organization of the Term Paper can be found in:
http://www.sce.carleton.ca/faculty/wainer/papers/SIW-05s-Battle.pdf)

List of proposed projects

I. Definition of advanced Cell-DEVS models

There are different projects in this area:

a) Redefining and expanding your Assign2 models
b) Modeling and simulation of wildfires
c) Building Occupation models
d) Modeling and simulation of floods with Cell-DEVS
e) Cellular models of spread of diseases (Dengue fever, Measles)
f) Defining Cell-DEVS models with hexagonal and triangular meshes
g) Defining asymmetric Cell-DEVS models

II. Development of application model libraries for Cadmium

The Cadmium and CD++ tool allows modelling and simulating complex systems using the DEVS formalism. It has been used to define many different complex systems. In this case, we intend to build a set of libraries to be ready to use by Engineers or scientists intending to analyse system behaviour through modelling and simulation. The idea of this project is to build mappings between formalisms. The following projects can be faced:

a) Building a library of QSS models for hybrid models
b) Building a library of Timed Petri Nets or other similar methods in Cadmium
c) Building a library of Petri Nets in Cadmium
d) Building a library of Finite State Machines in Cadmium
e) Building a library of Bond Graphs in Cadmium

III. Real-Time DEVS models

Cadmium has been modified to include a runtime system that allows defining real-time deadlines. The idea of this project is to create a sample application in which there will be Real-Time models built as DEVS components and interfaces microcontrollers for robotics, building automation, or other real-time applications.

IV. From DEVS graph model specification to Cadmium code

Implementing models formally defined in DEVS may is sometimes complex to understand, in particular for domain experts that are interested in modeling but not in programming. The objective of this project is to work with a tool built for automating the implementation of DEVS models using a graphical interface. You will need to use a graphical version of DEVS models that generates models in Cadmium. The objective is to complete a full model using the graphical tools and model generation.

V. Music generation with cellular models (basic knowledge of music theory mandatory)

The basis of music is an organization of sound frequencies, timed in a certain manner. Also, there is a certain range and values of frequencies used in the creation of music. This implies that there are a discrete number of frequencies that can be used. Since music is also time based, it can be extrapolated that there is possibly a model for the musical system, which will determine the frequencies to be played. This model could be described as a discrete event system because of the organization of frequencies. The project focuses on the extension of a mapping tool for creation of music using cellular automata models. Several cellular automata have been shown to have similar patterns to that of musical

structures. A mapping technique will be employed to extract the layers of musical composition. This mapping technique will use a top to bottom approach, where the highest musical structure will determine the lower structures.