Course Information

to

Computer Simulation: Real World Problems

Course: CAPS 491.36 Spring 2001

Instructor: Katharina Vollmayr-Lee
152 Olin
Phone: 577-3109
Email: kvollmay@bucknell.edu

Classes: MWF 9 - 10 am
Room: Dana 231

Office Hours: WF 1-3 pm and by appointment

Texts: REQUIRED:

- Any book on C. If you have none yet I recommend:
  (all other class material will be in the form of hand outs)

OPTIONAL:

- T. Toffoli and N. Margolus, Cellular Automata Machines,

- R. J. Gaylord and P. R. Wellin, Computer Simulations with

- H. Gould and J. Tobochnik, An Introduction to Computer
  Simulation Methods. Applications to Physical Systems, part

Course Description: This course is about computer simulations across disciplines.

During the last 30 years the computer has revolutionized the
natural sciences and other disciplines such as finance and music.
Computers have made it possible to study for example the reasons
for traffic jams, stock market crashes, and the shapes of
snowflakes. In these and many other examples, a simple rule
governs a single element, such as a a car, an investor, or a water
molecule, which then gives rise to the complex behavior of the
system as a whole. The computer takes care of applying the rules
to a large number of elements.
Objectives: You will learn in this class how to write and run your own C programs and how to analyze the resulting data. We will start with an introduction to Unix and C. For the remainder of the course you will learn about modeling (the elements and rules) via the examples named in the course description and others.

Course Structure: This course will be a mixture of lecture, in-class work and seminars (given by you!). As preparation for class you will get daily assignments such as reading assignments with a few questions and/or small programs. You will work on class-related smaller projects which will be discussed about every other Friday (marked in syllabus with *). Since the course will be evolving based on your input, it will be essential that you come prepared to class.

Additionally, each of you will have your own project where you choose your subject, model, and literature and write your own program. You will present preliminary results in class. After “playing” with your program, you will present your final results in a public conference. As part of this project, you will assemble your own portfolio, which will include your search for a topic, the bibliography, a paper about the background of the topic and a precise description of the model, the flow diagram, the program, the final paper, and any other neat material, such as magazine articles or photos. You will be assisted with your project.

Grading: There will be no exams and no final. It is important that you work steadily on your project and the class preparations. Since your participation is essential, attendance is required and will be graded together with your daily assignments (20 %!). For any late daily assignment you will get no credit. For the Friday projects you will write 1-2 page long papers (due at the corresponding Friday) and you will present your results in a 5-10 min long talk. For the main project of your own choice you will write two papers. The first will be about the background of your subject and a precise description of the model. A complete description of your project, including model, program, data analysis and conclusions will be in your second paper. For any late paper you will get a 10% point reduction for each late calendar day (maximal reduction: 50%). We will make a pamphlet with the abstract for your final, public presentation. To maintain the right pace for your project note the deadlines given in the syllabus.
Grading (continued):

- Daily Assignments: 20%
- Friday Projects:
  - Papers: 20%
  - Talks: 20%
- Main Individual Project:
  - Bibliography & Flow Diagram: 8%
  - First Paper: 8%
  - First Talk: 8%
  - Second Paper: 8%
  - Second Talk: 8%

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### Course Syllabus

<table>
<thead>
<tr>
<th>Dates</th>
<th>Topic</th>
<th>Due Dates of Main Project</th>
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<tbody>
<tr>
<td>Jan. 17</td>
<td>Intro. to Computer Simulations</td>
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<tr>
<td>Jan. 19*/22/24/26*/29</td>
<td>Introduction to Unix &amp; C</td>
<td>Jan. 26: Bibliography</td>
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<tr>
<td>Jan. 31 Feb.2/5/7/9*</td>
<td>Cellular Automata; Game of Life</td>
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<tr>
<td>Feb.12/14/16/19/21/23*</td>
<td>Traffic Flow</td>
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<td>Feb.26/28 March 2</td>
<td>Stella &amp; Applications</td>
<td>March 2: First Paper</td>
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<td>March 5/7/9</td>
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<td>Presentations of First Paper</td>
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<tr>
<td>March 28/30* April 2/4/6*</td>
<td>Fractal Growth</td>
<td>April 2: 1st Working Program</td>
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<td>April 9/11/13* /16/18</td>
<td>Finance</td>
<td>April 16: Abstract</td>
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<td>April 20/23</td>
<td>Protein Folding</td>
<td>April 23: Final Paper</td>
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<tr>
<td>April 25/27/30</td>
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<td>Presentations of Final Paper</td>
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