Mathematics of Computer Simulations: 4984/15748

Course Policy Sheet

Background: The use of discrete mathematics is becoming increasingly more wide-spread in applied mathematics. The motivation for this course is the space and time discrete dynamical system models used in simulation and analysis. Application examples include traffic models of entire cities (Transims), disease dynamics in social networks (Episims), and models of biological systems such as the immune system (Celada-Seiden model).

This course is about the mathematical structures and properties of the discrete dynamical systems used in the simulation models above. Through the framework of sequential dynamical systems and generalized cellular automata the course gives a thorough introduction to mathematical results and techniques that can be used to analyze these systems. In contrast to the continuous dynamical systems you may have seen in other courses, the techniques in this course are based on abstract algebra, combinatorics and graph theory. The course offers a great opportunity to learn how all these areas can be combined to analyze finite dynamical system.

Course Information:

Instructor:	Henning S. Mortveit	Phone:	(540) 231-5327
Time:	9:30-10:45 TR	Place:	McBryde Hall 207
Office I:	RBXV 1111 (Corporate Research Center)	Office II:	McBryde 419
Email:	hmortvei@math.vt.edu		
Web:	http://www.math.vt.edu/people/hmortvei/		
Office hours:	TR 11:00-12:00 (McBryde Hall)		

Meeting by appointment is also fine.

Text/course material: The course will be based on lecture notes that will be made available from the course web page or that will be distributed by email to the students. Please see the list off supplementary literature references at the end.

Exams, Tests, Assignments, and Grading:

Some of the pdf files such as those containing assignments and solutions will be password protected. The case-sensitive password is listed on the syllabus hand-out. Contact me if you have lost the password.

Final exam: There will be a final exam on Wednesday, May 08. The exam is worth 35 pts.
Mid-term exam: There will be a mid-term exam worth 25 pts on March 01. If you cannot take the tests at the scheduled time, please let me know as soon as possible and before the tests. Make-up tests will be given for reasons that in my judgement are acceptable.

Assignments: There will be four written assignments for regular credit (10 pts each) and two computer-based assignments for extra credit (5 pts each). Late homework may not be accepted.

Grading: Is on a curve. However, 90% will be at least an A-, 80% will be at least a B-,70%

will be at least a C-, and 60% will be at least a D-.

Attendance: Will be taken, and will be kept for Mathematics Department records. It may be applied as extra credit.

Prerequisites:

The three courses

- 3034 Introduction to Proofs,
- 3124 Modern Algebra, and
- 3144 Linear Algebra I

or equivalents courses, or permission from me are required. The second and third course may be taken along with this course. Having taken 3134 Applied Combinatorics and Graph or some other course in combinatorics or graph theory is probably helpful, but is not necessary.

Honor System: The University Honor System is in effect for in-class tests and all exams. (See: http://www.honorsystem.vt.edu)

Supplementary References: The following is a list of references that may be helpful as support material in the course. The books range from intermediate to advanced and are in the areas of graph theory, combinatorics and (classical) dynamical system theory. References on SDS are available at the course web pages. Feel free to ask me about additional references.

- R. Diestel: "Graph Theory", GTM vol. 173, Springer-Verlag. (Electronic version available at http://www.math.uni-hamburg.de/home/diestel/books/graph.theory/)
- C. Godsil and G. Royle: "Algebraic Graph Theory", GTM vol. 207, Springer-Verlag. (A more advanced book.)
- J. H. van Lint and R. M. Wilson: "A Course in Combinatorics", Cambridge University Press, 2nd edition.
- J. Riordan: "Introduction to Combinatorial Analysis", Dover Publications. (Many recommend this book - I have not studied it.)
- R.P. Stanley: "Enumerative Combinatorics: Volume 1", Cambridge University Press. (An advanced but nice book on combinatorics.)
- M.W. Hirsch, S. Smale, R. Devaney: "Differential Equations, Dynamical Systems, and an Introduction to Chaos", Academic Press. (Supposedly a good book. I have only studied the older book by the first two authors.)

- R.L. Devaney: "An Introduction to Chaotic Dynamical Systems" (A somewhat advanced book on the dynamics of iterated maps from a chaos perspective.)