Principles of Complex Systems

CSYS/MATH 300; Instructor: Prof. Peter Dodds
Tuesdays & Thursdays, 10:00 to 11:15 am in 307 Lafayette
Level: Graduate/Advanced Undergraduate

Synopsis:

Many of the problems we face in the modern world revolve around comprehending, controlling, and designing multi-scale, interconnected systems. Networked systems, for example, facilitate the diffusion and creation of ideas, the physical transportation of people and goods, and the distribution and redistribution of energy. Complex systems such as the human body and ecological systems are typically highly balanced, flexible, and robust, but are also susceptible to systemic collapse. These complex problems almost always have economic, social, and technological aspects.

So what do we know about complex systems? The basic aim of this introductory interdisciplinary course is to present a suite of theories and ideas that have evolved over the last couple of decades in the pursuit of understanding complex systems. The central focus will be on understanding small-scale mechanisms that give rise to observed systemic phenomena. Students will be encouraged to see how different areas connect to each other and, just as importantly, where analogies break down.

Potential topics:

Measures of Complexity	Complex Social Phenomena
Scaling Phenomena	Social & Biological Contagion
Growth Processes	Collective Decision Making
Hierarchies and Modularity	Cooperation
Complexity from Simple Rules	Information & Search
Robustness & Fragility	Network Analysis and Visualization
Complex Networks	Distribution Systems

Please visit http://www.uvm.edu/~pdodds/teaching/ for more information and/or send email to pdodds@uvm.edu.