CSCS 511 Theory of Complex Systems  
Fall 2012  
M 1-4  
Scott E Page  
Center for The Study of Complex Systems  
317 West Hall  
scottepage@gmail.com  
www.cscs.umich.edu/~spage

Course Description:
In this course, we study some classic papers and topics in complex systems.  
The course assumes that students have a general introduction to complex  
adaptive systems. In the course we focus on models, tools, concepts, and  
ideas from complexity theory including complexity measures, non linear dyna-
mics power laws, percolation, rugged landscapes, simulated annealing, ge-
netic algorithms, Self Organized Criticality, networks, learning, and collective  
wisdom. The course will require knowledge of calculus, some basic familiarity  
with difference and differential equations, but will not require any computer  
programming.

Grades: Grades will be based on two group projects (20%), weekly individual  
homework assignments (40%), and a final exam (40%)


Background Reading:
Miller, John, and Scott E Page Complex Adaptive Social Systems, Princeton  
University Press, 2008  
(2011)
Course Outline

Sept. 10: Information, Algorithms, and Distributions
Li, M. and P Vitanyi, “Algorithmic Complexity”

Sept. 17: Measuring Complexity

Sept. 24: Rugged Landscapes and the NK Model

Oct. 1: NO CLASS

Oct. 3: Wednesday Group Project 1: Pecha Kucha on Complexity Measure Due
Oct. 8: Wolfram's Cellular Automata Model, Langton’s Lambda Parameter:


Oct. 22 Linear Stability Analysis

Strogatz, Steven *Nonlinear Dynamics and Chaos* Chapters 1-2.
http://users.uoa.gr/~pjioannou/nonlin/Strogatz,%20H.%20Nonlinear%20Dynamics%20

Oct 29: Adaptation


Golman, Russell and Scott E Page, "Basins of Attraction and Equilibrium Selection Under Different Learning Rules" *Evolutionary Economics* 20: 49-72, 2009


Willemien Kets, "The minority game: An economics perspective", arxiv:0706.4432

Nov. 2: Friday Group Project 2: Analysis of Complex Systems Technique from Shalizi


Nov. 5: Phase Transitions and Bifurcations


3
Nov. 12: Tipping Points and Path Dependence
Bednar, J, Page, Scott E, and Jameson Toole, “Revised Path Dependence” Political Analysis

Nov. 19: Self Organized Criticality and Power Laws
Bak, Per How Nature Works, Princeton University Press (optional)

Nov. 26: Networks

Dec 3: Genetic Algorithms, Simulated Annealing, and No Free Lunch
Miller, John, and Scott E Page Complex Adaptive Social Systems, Princeton University Press, 2008 (excerpt)

Dec. 10: Collective Wisdom
Hong, Lu and S.E. Page "Interpreted and Generated Signals" *Journal of Economic Theory* 144: 2174-2196, (2009)

Hong, Lu, M. Riolo and S.E. Page "Individual Learning and Collective Intelligence" *Managerial and Decision Economics*


**Dec. 20 Final Exam: 1:30-3:30**